Ann. Natal Mus. Vol. 25(2) Pages 549–585 Pietermaritzburg October, 1983

Turridae (Mollusca: Gastropoda) of southern Africa and Mozambique. Part 1. Subfamily Turrinae

by

R. N. Kilburn

(Natal Museum, Pietermaritzburg)

SYNOPSIS

Twenty species of Turrinae are here reported from South Africa. Of these, three *(Turris ruthae, T. orthopleura, Gemmula championi)* are new, and seven (*Turris garnonsii* (Reeve, 1843), *T. crispa* (Lamarck, 1816), *Gemmula cosmoi* (Sykes, 1930), *G. kieneri* (Doumet, 1840), *G. rosario* Shikama & Hayashi, 1977, *G. monilifera* (Pease, 1861) and *G. rarimaculata* Kuroda & Oyama, 1971) are new regional records. *Turris ambages* Barnard, 1958, and *Gemmula gilchristi* (Sowerby, 1902) are reinterpreted. Radulae of *Gemmula cosmoi, G. kieneri, G. rosario, G. rarimaculata, G. gilchristi* and *Turris ruthae* are figured for the first time. *Lophioturris* Powell, 1964, is synonymised with *Lophiotoma* Casey, 1904, and *Xenuroturris* Iredale, 1924, is regarded as a subgenus. *Pinguigemmula* (MacNeil, 1960), and *Ptychosyrinx* Thiele, 1925, are reduced to subgenera of *Gemmula* Weinkauff, 1875. *Micropleurotoma* Thiele, 1929, is transferred to the Cochlespirinae, and *Turridrupa* Hedley, 1922, provisionally to the Clavinae.

INTRODUCTION

> 'The marine gastropods embraced in the family Turridae . . . are considered by those who meddle with them to be more perplexing than any other molluscan family' (Hedley, 1922).

The Turridae is a very large family of at least two thousand Recent species, which inhabit low stress environments in all seas. Maximum species diversity is found in offshore and deep-sea sediments, and at least 50% of the predatory gastropods found at abyssal depths are turrids (Taylor, Morris & Taylor 1980). Taxonomically the Turridae has been much neglected, and Hedley's comment, quoted above, is as pertinent today as it was in 1922. A number of factors are responsible. For example, museum samples tend to be embarrassingly small, a consequence of the low population density characteristic of such biologically competent animals (*sensu* Vermij 1978). The size and complexity of the family is an obvious complicating factor; on the one hand intense regional speciation has produced a high percentage of often poorly studied endemics; on the other hand the great vagility of the larval stages of many others has resulted in wide distributions and a proliferation of local synonyms. Identification problems have been exacerbated by the low to execrable standard of description prevailing among many early (and some modern) turrid workers. Between 1877 and 1880 E. A. Smith, for example, described nearly 200 species without providing a single figure; a large number of his taxa remain unfigured to this day. Many of the species proposed by the 'classical' authors such as Reeve, Hinds and Melvill are equally unrecognisable from the tiny detail-less figures provided. Probably no other molluscan family provides equal potential for the unwitting creation of superfluous names!

The present series of papers is intended as a purely regional revision, aimed at provisionally defining the non-abyssal turrid fauna of southern Africa and Mozambique. At the outset, however, it must be pointed out that this study is based on current museum collections, and that systematic dredging of the shelf and slope benthos would probably at least double the number of species available.

Colour terminology in all *formal* descriptions follows that of the ISCC–NBS system. Elsewhere more general terms are used.

Abbreviations: NM = Natal Museum; *MN* = R/V *Meiring Naudé*; SAM = South African Museum, Cape Town; BM(NH) = British Museum (Natural History).

Subfamilies of the Turridae

McLean (1971) has summarised the history of the subfamilial classifications of the family. In essence, Powell (1966) recognised 9 turrid subfamilies, based primarily on shell characters, in the belief that different lineages exhibited parallel evolution of the radula. McLean disagreed, and proposed 15 subfamilies, distinguished by different combinations of shell, radula and opercular characters. However, Shimek & Kohn (1981), using McLean's groupings, found no congruence between phenograms based on radula structure and shell morphometry; moreover, from an SEM study of radula structure and function it was suggested that the toxoglossate condition had arisen at least twice within the Turridae. Bouchet & Warén (1980) eschewed subfamily groupings, regarding existing classifications as artificial.

For the present series of papers the pragmatic viewpoint is adopted that in a family as large and complex as the Turridae, virtually any practical subdivision is better than none. The subfamily classification used will be essentially that of Powell, with some modification.

SUBFAMILY TURRINAE SWAINSON, 1840

Diagnosis: Shell more or less fusiform, with a well-developed siphonal rostrum; anal sinus situated on periphery or immediately above it; columella smooth, paries without callus; protoconch smooth or with terminal axial ribs, rarely with a keel. Operculum with terminal nucleus. Radula of flattened marginal plates with cutting blade and accessory limb; rachidian plate present or absent.

Remarks: Two genera previously referred to the Turrinae are here excluded.

(i) *Micropleurotoma* Thiele, 1929, has been referred to the Turrinae solely on account of the supposedly peripheral anal sinus of the type species, *Pleurotoma spirotropoides* Thiele, 1925. However, the position of the sinus in *spirotropoides* is variable (see Bouchet & Warén 1980: Fig. 60), and it may lie on the shoulder slope in some individuals. From this and from the radula (*idem*, Fig. 4) it would appear that the Cochlespirinae (= Turriculinae) is the most natural position for the genus.

(ii) *Turridrupa* Hedley, 1922, is an anomalous group of species whose radula characters do not conform well with those of any established subfamily, but whose shell is decidedly clavinid. Despite statements to the contrary, adult *Turridrupa* of at least some species (*cincta, cerithina* and *prestoni*) develop a parietal tubercle that constricts the posterior aperture angle exactly as in the nominate clavinid genus *Clavus*. Although *Turridrupa* lacks the plesiomorphic pectinate lateral plates of typical Clavinae, its marginal plates (more significantly) are without the apomorphic accessory limb found in the Turrinae. McLean (1971) and others have restricted the Clavinae to species with 'prototypic' radulae, but a synplesiomorphy such as this is not a sound basis from which to deduce phylogeny, and Powell's (1966) concept is perhaps closer to a natural grouping. For the present it will just be noted that *Turridrupa* is too discordant an element to be included within the Turrinae.

Notes on the protoconch in the Turrinae

Controversy as to the value of the protoconch as a guide to phylogeny has continued unabated over the years. In practice, turrid taxonomists have usually treated protoconch characters as a key indicator of systematic relationships. Yet modern studies on larval ecology suggest that phylogenetic modifications of the premetamorphic shell are at least balanced by the adaptive influence of reproductive mode. The most conservative view is summed up by Robertson (1976): 'It is clear that there is no justification for genera based exclusively on protoconch differences, especially if the geographic ranges are in different latitudes.'

From my studies it is impossible to formulate any protoconch dogma. Within the Turrinae, there appear to be cases where protoconch form is possibly adaptive, but other examples seem to demonstrate pure phylogeny. As a possible case of adaptation may be cited the variation noted below in *Lophiotoma indica*, where the mud-dwelling South African population shows a protoconch typical of the genus, whereas that of the sand-dwelling Queensland form shows more resemblance to *Turris* (Figs 4, 5). However, the possibility exists that this will prove to be a case of geographical rather than ecological variation. Another double option is provided by the pupoid, polygyrate, ribbed protoconch of *Gemmula*. Is this merely indicative of planktotrophic larval development, or is it an apomorphy? Similarly, is the blunt, paucispiral, smooth protoconch of *Turris* only indicative of direct development or can it be regarded as plesiomorphic within the Turrinae? A clue may be provided by the fact that protoconch form and species-distribution are not rigidly correlated. For example, *Turris crispa* with a blunt, paucispiral protoconch has a very wide distribution, yet some *Gemmula* and *Lophiotoma* (s.l.) with supposedly planktotrophic protoconchs have very local ranges (see Powell 1964).

If any conclusion is possible, it is that protoconch characters probably contain valuable phylogenetic information, but that parallelism and character-reversals, probably in response to dispersal pressure, may provide confusing data.

Part of the difficulty in analysing protoconch significance within the Turrinae lies in the fact that the *Lophiotoma* complex is a non-A group (*sensu* Eldredge & Cracroft 1980) without a single unifying apomorphy. Phylogenetically it might be sounder to divide the taxon into small workable units, without making unprovable assumptions as to their relationships. Taxonomically, however, it is far more practicable to unite them until evidence can be offered to the contrary. Thus I have reduced *Xenuroturris* to a subgenus of *Lophiotoma*; consequently within the genus as here interpreted may be found a full transformation-sequence of protoconch characters, from the paucispiral, smooth *Turris* state (of some *Lophiotoma* s.s.) to the polygyrate, ribbed *Gemmula*-type (in *Xenuroturris*). I would, perhaps, unite here also *Unedogemmula* MacNeil, 1960, regarded as a subgenus of *Gemmula* by Powell (1966) on account of the presence of feeble peripheral granules on the early whorls. These granules may be a simple case of parallelism, as phenetic resemblances between *Lophiotoma* and *Unedogemmula* are certainly greater than between *Gemmula* and *Undogemmula*.

We are evidently dealing with mosaic evolution whose pathways will only be unravelled when full information, including data from other organ systems, is available.

Key to the genera of southern African Turrinae

1 Anal sinus situated on a ridge above peripheral keel .... **Turris**
– Anal sinus situated on peripheral keel 2
2 Shell clavinid, with short, broad, barely differentiated siphonal rostrum; axial sculpture fine but distinct, spiral ridges granular or tuberculate .... **Epidirona**
– Shell fusiform, with long to short, well-differentiated siphonal rostrum; no distinct axial sculpture 3
3 Peripheral keel (sinus rib) gemmate .... **Gemmula**
– Peripheral keel not gemmate .... **Lophiotoma**

Turris Röding, 1798

Turris Röding, 1798: 123. Type species (s.d. Dall 1909) *Murex babylonius* Linné, 1758.

Diagnosis: Characterised by the position of the anal sinus on a ridge (the shoulder cord) above the peripheral cord, and by the blunt, paucispiral protoconch. Although said to be small and smooth by Powell (1966), the protoconch on the one hand may be large and almost bulbous in subtropical species *(orthopleura, ruthae)*, and on the other may develop feeble to strong brephic axials (*ambages, orthopleura, nadaensis* Azuma, 1973 and *brevicanalis* (Kuroda & Oyama, 1971)).

The status of the subgenus *Annulaturris* Powell, 1966, is difficult to judge. As stated by its author, the presence of a rachidian may or may not be significant, although the marginal plates of the type species, *amicta* (E. A. Smith, 1877), do indeed differ from those of the type species of *Turris* s.s. However, the shell characters given by Powell apply to the type species and to *T. orthopleura* (herein), but not to the second species, *annulata* (Reeve, 1843), associated with *Annulaturris* by its describer. The radula of *T. ruthae*, described below, similarly possesses a rachidian, while its marginals are equally distinctive in their characters. It is felt that little is to be gained at this stage by the naming of possibly monotypic exceptions, when the fundamental pattern of dentition for the genus has still to be established.

Key to the Mozambique and southern African species of *Turris*

1 Spire flat-sided, spiral sculpture of thin, widely spaced threads; anal sinus shallow; periostracum present .... **orthopleura**
– Spire not flat-sided, spiral sculpture of strong cords; anal sinus deep; no distinct periostracum 2

2 Shoulder cord bearing lunulate crenules; colour pattern subdued or absent; smaller, possibly endemic forms 3

– Shoulder cord not crenulate; vividly spotted with deep brown; large tropical forms 4

3 Spiral cords rounded, shoulder sulcus wide and gently concave; subsutural cord weakly differentiated, spire whorls with strongly projecting periphery . . . . **ruthae**

– Spiral cords angular, shoulder sulcus very narrow and channelled, subsutural cord strong; spire whorls with weakly projecting periphery . . . . **ambages**

4 Peripheral keel prominent, situated below midwhorl, rendering whorls angular; subsutural cord barely projecting . . . . **garnonsii**

– Peripheral keel not prominent, at or above midwhorl level, rendering whorls gently convex; subsutural cord strong 5

5 Siphonal rostrum markedly curved, shorter than rest of aperture; growth lines not lamellate; with broken axial bands of brown . . . . **tanyspira**

– Siphonal rostrum more or less straight, subequal to rest of aperture; growth lines lamellate; ridges spotted and flecked with brown . . . . **crispa**

Turris crispa crispa (Lamarck, 1816)

Pleurotoma crispa Lamarck, 1816: 8, pl. 439, fig. 4. Type locality unknown.
Turris crispa crispa; Powell, 1964: 330 (references), pl. 181, figs 9–12; *idem*, 1966: text fig. C41 (radula).

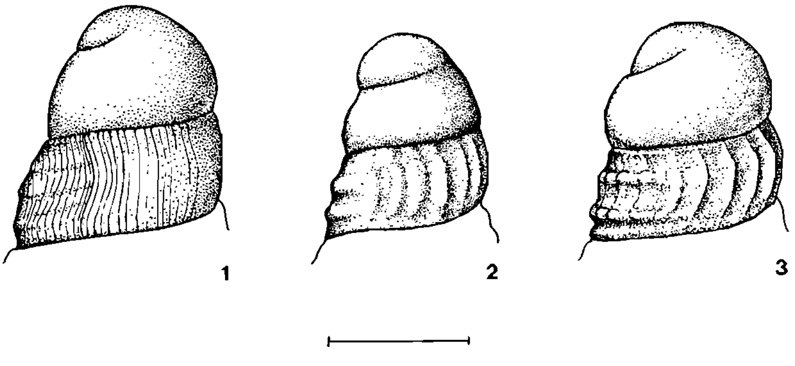
Known range: Western Pacific to Madagascar, here extended to Mozambique.

Regional locality data: NORTHERN MOZAMBIQUE: Conducia Bay, living in gravelly sand above *Thalassodendron*, little wave-action (NM H2447: K. J. Grosch). CENTRAL MOZAMBIQUE: North of Beira, 10–20 fathoms, trawled (NM G3767: B. Lafferty).

Turris garnonsii (Reeve, 1843)

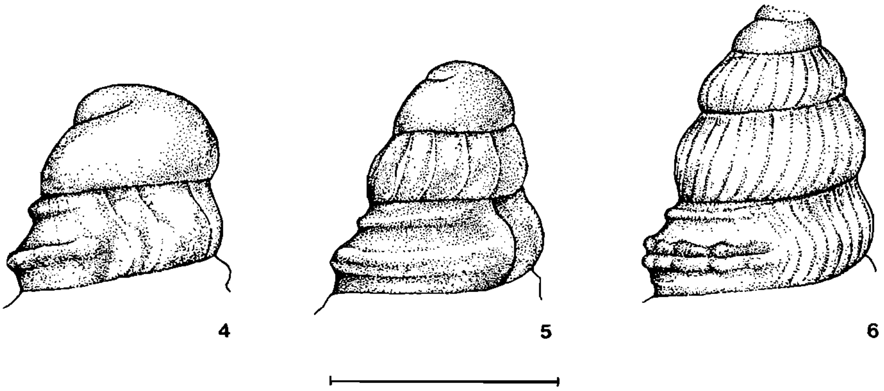
Pleurotoma garnonsii Reeve, 1843: pl. 1, sp. 4. Type locality: Zebu [= Cebu], Philippines.
Turris garnonsii; Powell, 1964: 329 (references), pl. 181, figs 7, 8, 18, pl. 254, fig. 1 (holotype).

Known range: Philippines to Mauritius and Tanzania, here extended to northern Mozambique.

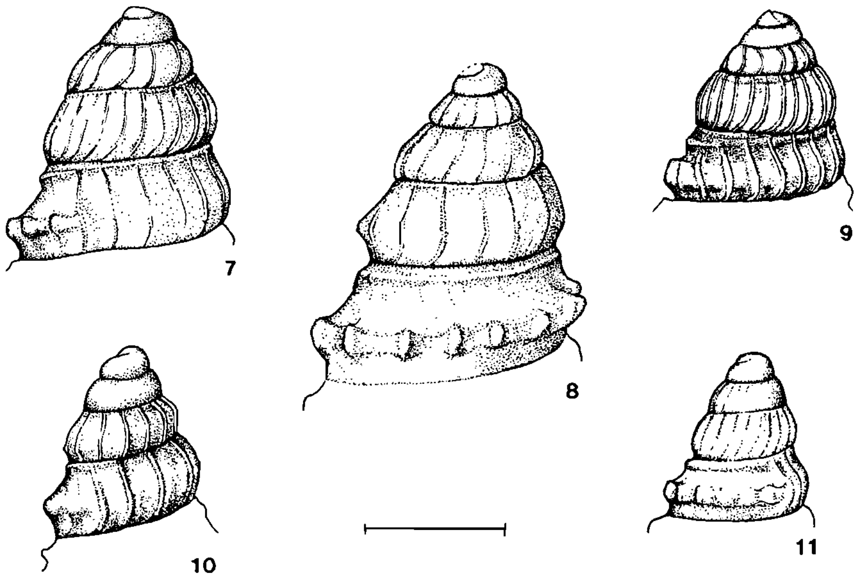


Figs 1–3. Protoconchs of *Turris* species: 1, *T. ruthae* sp. n.; 2, *T. ambages* Barnard, 1958; 3, *T. orthopleura* sp. n. Scale line = 1 mm.

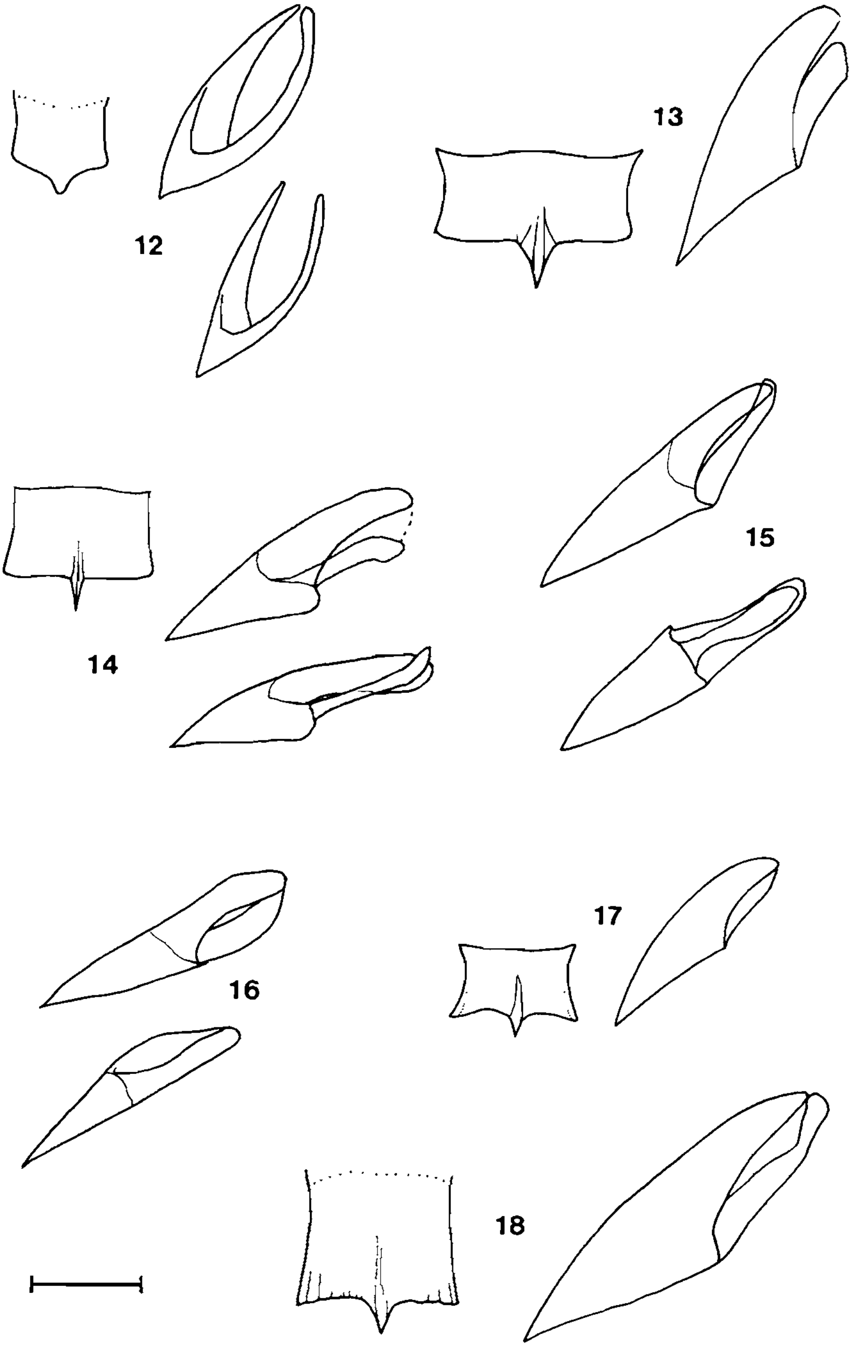
Regional locality data: NORTHERN MOZAMBIQUE: Conducia Bay, sandy area with rocks, above *Thalassodendron*, 1 ft above LST (NM H2458: K. Grosch), and in muddy sand with rocks, LST, no surf (NM H2459: K. Grosch).



Figs 4–6. Protoconchs of *Lophiotoma* species: 4, *L. indica* (Röding, 1798), Broadsound, Queensland, littoral; 5, *L. indica*, Port Grosvenor, Transkei, 120–128 m; 6, *L. (Xenuroturris) cingulifera* (Lamarck, 1822). Scale line = 1 mm.



Figs 7–11. Protoconchs of *Gemmula* species: 7, *G. kieneri* (Doumet, 1840); 8, *G. cosmoi* (Sykes, 1930); 9, *G. rarimaculata* Kuroda & Oyama, 1971; 10, *G. gilchristi* (Sowerby, 1903); 11, *G. rosario* Shikama & Hayashi, 1977. Scale line = 1 mm.



Figs 12–18. Radulae of some southern African Turrinae: 12, *Turris ruthae*; 13, *Gemmula kieneri*; 14, *G. cosmoi*; 15, *G. rosario*; 16, *G. gilchristi*; 17, *G. rarimaculata*; 18, *G. thielei*. Scale line = 0,05 mm.

Turris tanyspira Kilburn, 1975

Turris tanyspira Kilburn, 1975: 603, fig. 15. Type locality: north of Beira, Mozambique, 10–20 fathoms.

Notes: Only one other specimen of this rare species has come to hand (NM H7347: B. J. Young). Although labelled 'trawled off Kismayu, Somaliland', this locality is outside the normal range of local trawlers and cannot be accepted without confirmation. This example retains worn vestiges of the protoconch, which measures only 0,8 mm in basal diameter, shows traces of axial ribs, and probably consisted of at least three whorls. This type of protoconch is not yet known to occur in the genus *Turris*.

Comparison with specimens of the closely-related *Turris nadaensis* Azuma, 1973, from the Philippines (Palawan, NM J3949: F. J. Springsteen, and West Samar, NM G8252: F. G. Dayrit) confirm the differences given in the original description of *tanyspira*.

Turris ambages Barnard, 1958. Figs 2, 19–21

Turris ambages Barnard, 1958: 148, fig. 231; Powell, 1964: 337; Barnard, 1969: 604, figs 3a, b; Kensley, 1973: 202, fig. 798. Type locality (here designated): Off O'Neil [= Neill] Peak, Zululand, 90 fathoms.

Diagnosis: Medium-sized (4,5 cm), aperture 0,33–0,36 total length, spire orthoconic with moderately angular whorls, shoulder sulcus narrowly channelled, subsutural cord slightly angular, well defined; shoulder cord with lunulate crenules; basal periphery with 3 strong, angular main cords; protoconch of 2½ whorls, maximum diameter 1,25 mm, with brephic axial ribs; cream-colour, sometimes with irregular brownish marks.

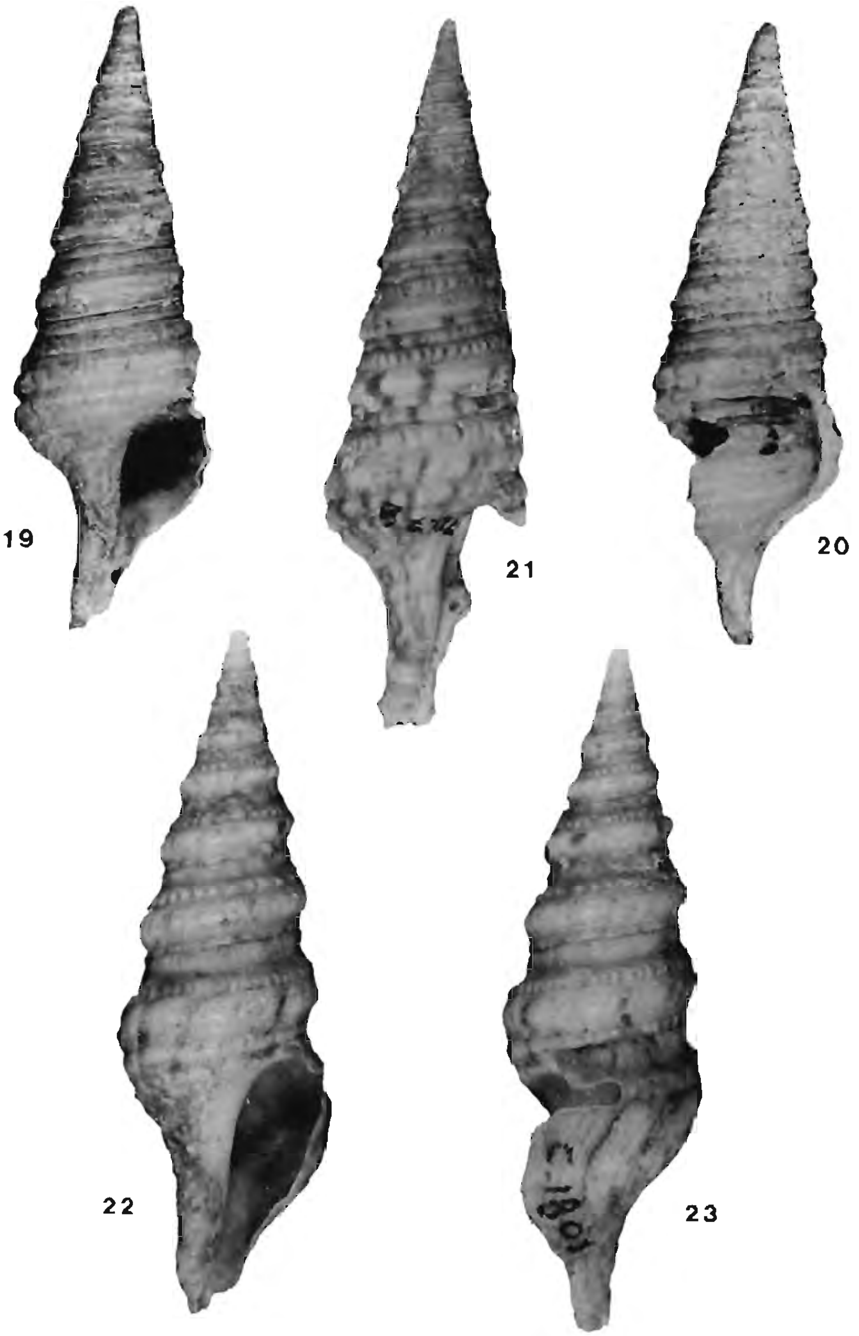
Description: Shell with about 12 teleoconch whorls, aperture much shorter than spire (0,33–0,36 of total length), spire orthoconic, whorls slightly convex with a basal angle, sutures relatively shallow, not channelled. Subsutural cord simple or shallowly bifid, finely pliculed by growth striae, slightly weaker than shoulder cord. Shoulder sulcus narrowly channelled, much narrower than subsutural cord. Anal sinus widely open and relatively shallow, forming a series of low, lunulate, somewhat imbricate crenules (scarcely gemmules) on the shoulder cord. Periphery of base with 3 rather angular main spiral cords, the posteriormost (which is the strongest and forms the periphery of the spire whorls) and at least part of the second whorl showing above suture. Rest of base and rostrum with well-spaced spiral lirae, sometimes nodular, becoming progressively weaker anteriorly, intermediary lirae few or absent.

Colour yellowish-white, sometimes with irregular streaks and patches of brownish-orange, particularly between crenules.

Protoconch (Fig. 2) of about 2½ whorls, the initial one blunt and relatively large, the whorls smooth, except for the terminal quarter- or half-whorl, which bears arcuate, axial riblets; diameter 1,25 mm.

Dimensions: 25 × 8 mm (holotype); attains 46,1 mm (NM B3478, lip broken).

Range: Continental shelf of Natal and Zululand, from Neill Peak to Scottburgh, in about 73–165 metres.



Figs 19–23. *Turris ambages* Barnard, 1958, and *T. ruthae* sp. n.: 19–21, *T. ambages*: 19–20, holotype, 25 × 8 mm; 21, damaged adult, length 46,1 mm, off Scottburgh, 100 m; 22–23, *T. ruthae*, holotype, 44, 5 × 14,4 mm.

Locality data: Zululand: off Neill Peak, 90 fath. (SAM A8685: s.s. *Pieter Faure*, holotype). NATAL: off Durban, 54 fath. (SAM A8683: s.s. *Pieter Faure*, two fragmentary paratypes); off Umkomaas, 40 fath. (SAM A8684: s.s. *Pieter Faure*, one juvenile paratype); off Scottburgh, 100 m (NM B3478: A. Connell, one broken adult).

Remarks: Recognition of this inadequately-described species has only been possible through examination of the types, themselves juvenile or broken. As the only adult specimen available is also damaged, knowledge of the species is clearly incomplete. Nevertheless, the characters of *T. ambages* certainly indicate a valid species, whose crenulated sinus rib allies it to *T. ruthae, T. brevicanalis* (Kuroda & Oyama, 1971) and *T. annulata* (Reeve, 1843). The tropical *T. annulata* (= *Pleurotoma fagina* Adams and Reeve, 1850), with which Barnard correctly compared his species, is much larger, with flatter whorls and subequal spiral cords, the peripheral one being no more prominent than its neighbours. *T. ambages* and *T. ruthae* are compared below. *T. brevicanalis* of Japan, according to an NM specimen (J3684: M. Azuma) is perhaps the closest, but has evenly convex whorls with more numerous, less closely arranged spiral ridges, without a conspicuous peripheral cord.

Turris ruthae sp. n. Figs 1, 12, 22–23

Diagnosis: Medium-sized (4,5 cm), aperture 0,37–0,38 total length, spire somewhat cyrtoconic, whorls with projecting, rounded peripheral angle; shoulder sulcus broad and gently concave, subsutural cord weak and ill-defined, shoulder cord with lunulate crenules; basal periphery with 3 thick, rounded cords; protoconch of 2 whorls, maximum diameter 1,4–1,6 mm, with terminal growth-lines only; cream-colour, sometimes with diffuse brown spots.

Description: Shell with 9 teleoconch whorls, aperture much shorter than spire (0,37–0,38 total length), spire initially orthocline, later slightly cyrtoconic, whorls becoming progressively more angular with growth; sutures shallow, not channelled. On first 6–7 teleoconch whorls subsutural cord forms a weak ridge, sometimes bifid, delimited by a shallow sulcus; on later whorls the cord becomes progressively feebler and the shoulder sulcus wider and gently but distinctly concave. Anal sinus deep, sometimes constricted at opening, forming a series of low, lunulate crenules (about 38–40 on penultimate whorl) on shoulder cord; this cord initially develops as a pair of lirae bearing corresponding sets of crenules, which ultimately merge; in the adult the shoulder cord is relatively weak, little stronger than the subsutural one. Subsutural cord, shoulder sulcus and shoulder cord bear fine spiral striae and arcuate, prosocline, growth-lines. Periphery of base with 3 thick spiral cords of which the upper and most of the second show above sutures, the upper being massive and forming the peripheral angle of spire whorls, whereas the two anterior cords are progressively weaker, with concave intervals, subequal in width to them. Rest of base and rostrum with 10–12 anteriorly weakening spiral ridges crossed by coarse growth-lines, sometimes with irregular intermediary threads. All cords and ridges anterior to main peripheral one may develop weak granules. Surface somewhat porcellaneous, without evident periostracum. Yellowish-white, ridges often with diffuse spots of light to strong brown, situated mainly between granules and crenules; protoconch white.

Protoconch (Fig. 1) bluntly conical, of about two whorls, the first being relatively large; smooth except for a short terminal series of arcuate growth-lines; maximum diameter 1,4–1,6 mm.

Dimensions: 44,5 × 14,4 mm (holotype); 49,7 × 15,9 mm (paratype).

Radula (Fig. 12): Rachidian large and rather quadrate, with a small mesocone only; marginal plates with both arms very long and slender.

Range: Continental shelf of southern Natal and Transkei, from Scottburgh to Nthlonyane, 32–165 metres.

Type material: (all dredged from *R/V Meiring Naudé*). Holotype, off Port Grosvenor, Transkei (31°24,5 S, 29°57,2 E), 80 m, calcareous nodules and lithothamnion sheets (NM C1801/T2613: radula slide M157).

Paratypes: NATAL: paratypes 1–2, off Scottburgh, 100 m (NM B3482/T2614); paratypes 3–6, off Park Rynie, 120 m, rubble and solitary corals (NM B3782/T2615), paratype 7, do, 100 m, sand and sponge-rubble (NM B3758/T2616), paratypes 8–11, do, 104 m, sponge-rubble and fine sand (NM C1691/T2617); paratypes 12–13, do, 100–110 m, sponge-rubble (NM B3936/T2618); paratypes 14–18, off Trafalgar, 120 m, sand, sponge (NM B4899/T2619); paratype 19, off Port Shepstone, 70 m, eroded shell and sponge-rubble (NM B3708/T2620). TRANSKEI: paratype 20, off Port Grosvenor, 80 m, worn calcareous nodules (NM C656/T2621); paratype 21, do, 80–84 m, sand, calcareous nodules (NM C695/T2622); paratypes 22–23, do, 150 m, sponges, coral, (NM C339/T2623); paratype 24, do, 80–81 m, calcareous nodules (NM C929/T2624); paratype 25, off Whale Rock, 90 m, sponge-rubble, small pebbles (NM C1823/T2625); paratype 26, do, 150–165 m, coarse sand, discoid corals (NM C1860/T2626); paratypes 27–28, off Mncwasa Point, 32–35 m, fine sand (NM C1858/T2627); paratype 29, off Nthlonyane River, 90–95 m, calcareous pebbles (NM C2553/T2661); paratype 30, off Mendu Point, 92–100 m, rocks, hydroids, broken coral (NM C4741/T2703); paratypes 31–36, off Mendu Point, 66 m, coarse sand and rubble (NM C4782/T2702); paratypes 37–38, off Nqabara Point, 95 m, sponge and sand (NM C4152/T2701); paratype 39, off Nqabara Point, 70–75 m, mud, sandstone (NM C4710/T2700); paratypes 40, 41, off Qora River, 100 m, coarse sand, some sponge-rubble (NM C4822/T2705); paratypes 42–45, off Stony Point, 95 m, sponge-rubble (NM C4208/T2706); paratypes 46–54, off Sandy Point, 90 m, calcareous debris, coarse sand (NM C4500/T2704); paratypes 55–57, off Qolora River, 80 m, coarse sand (NM C3980/T2711).

Remarks: This very distinctive species is not uncommon towards the outer edge of the continental shelf in 70–150 metres, mainly in coarse sand and rubble. Most living examples have been dredged off western Transkei, indicating it to be a temperate water taxon.

T. ruthae is certainly closely related to *T. ambages*, but has much more angular whorls, a less abbreviated base, rounded (not angular) spiral cords with wider intervals, a wide, gently concave (instead of narrowly canaliculate) shoulder sulcus, and a less distinctly differentiated subsutural cord; the protoconch, too, differs in size and in other respects.

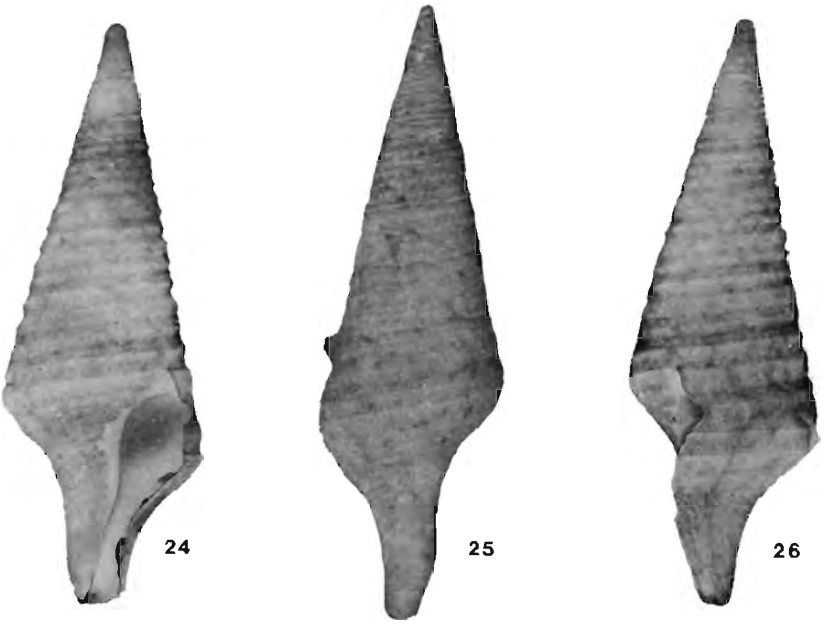
The radula of *T. ruthae* is distinctive. Indeed, the peculiar marginal plates differ from any illustrated for the genus *Turris*, and are closer to those of the Western hemisphere genus *Polystira* Woodring, 1928 (see Powell, 1966, text fig. C46–48); members of the latter genus have a very shallow sinus situated on the peripheral keel.

Named in honour of Mrs Ruth Fregona, in appreciation of her invaluable assistance both in the field and in the laboratory.

Turris orthopleura sp. n. Figs 3, 24–26

Diagnosis: Medium-sized (4 cm), aperture 0,30–0,36 total length, spire orthoconic, whorls flat, shoulder sulcus barely impressed, subsutural cord weak and ill-defined, anal sinus shallow, shoulder cord a thin, non-crenulate ridge, periphery of base with 3 thin cords plus intermediaries; protoconch of two whorls, maximum diameter 1,5 mm; white with faint light brown dots and a thin greyish-yellow periostracum.

Description: Shell with about 10½ teleoconch whorls; aperture much shorter than spire (0,30–0,36 total length); spire orthoconic, with flat whorls and barely impressed sutures. Subsutural cord very low and feebly differentiated in adult, its surface sometimes shallowly bifid, always with fine spiral and axial threads. Shoulder sulcus barely impressed, particularly shallow on later whorls. Anal sinus shallow, rather open, shoulder cord a thin, non-crenulated ridge, much weaker than



Figs 24–26. *Turris orthopleura*: 24–26, holotype, 29,0 × 10,0 mm; 25, paratype, off Trafalgar, Natal, 120 m, length 34,3 mm.

those anterior to it. Periphery of base with three rather weak main ridges, each separated by 2–4 fine intermediaries; of these main ridges two are visible on early whorls (which thus show a total of four ridges), the weaker second ridge being sometimes masked by the adult suture. Base of body whorl with numerous subequal lirae, with finer intermediaries. White with faint light brown dots and blotches; base sometimes tinged with light brown; protoconch light orange or white. Periostracum thin, greyish-yellow. Protoconch (Fig. 3) proportionately large (diameter 1,5 mm) of almost 2 whorls, the first markedly tumid; smooth except for the last half whorl, which bears 10–12 sharp, well-spaced, arcuate axial ribs.

Dimensions: 29,0 × 10,0 mm (holotype); 23,1 × 7,8 mm. Attains 38,2 mm (broken paratype).

Range: Continental shelf of southern Natal and Transkei, from off Park Rynie to Qolora River, 84–130 m.

Types: Holotype, off Mbashe (Bashee) River, Transkei (32°18,4 S, 29°00,4 E), 100 m, sponges, marine growths, little sand (NM 2834/T2609: *MN*). Paratype 1, off Nthlonyane, Transkei; 130 m, coarse brown sand, old calcareous fragments (NM C1833/T2612); paratypes 2 and 3, off Trafalgar, Natal, 120 m, sand and sponge (NM B4898/T2610: *MN*); paratype 4, off Park Rynie, Natal, 84 m, sponge-rubble (NM B4870/T2611: *MN*); paratype 5, off Kwanyana River, Transkei, 100 m, sponge-rubble (NM C5317/T2708: *MN*); paratype 6, off Stony Point, Transkei, 95 m, sponge-rubble (NM C4483: *MN*); paratype 7, off Qolora River, 114 m, sponge-rubble (NM C3949/T2709: *MN*).

Remarks: Although only dead shells, all either immature or damaged, are known, the characters of the species are very distinctive. Indeed, the flat whorls and level-sided spire, swollen protoconch, indistinct suture, and almost obsolete shoulder sulcus are unique within the genus. Of described species, *T. orthopleura* is most closely allied to *T. amicta* (E. A. Smith, 1877) of India, which has a similarly pale shell with conspicuous periostracum and relatively even spiral ridges; *amicta* differs in its convex whorls, strong subsutural cord and deep bordering groove.

Genus *Lophiotoma* Casey, 1904

Lophiotoma Casey, 1904: 130. Type species (s.d. Woodring, 1928) *Pleurotoma tigrina* Lamarck, 1822 [= *P. acuta* Perry, 1811]
Lophioturris Powell, 1964: 311 *(n. syn.)* Type species (o.d.) *Turris indica* Röding, 1798.

Diagnosis: Resembling *Turris* but with anal sinus on peripheral cord; protoconch paucispiral, smooth and domed, to polygyrate, ribbed and cyrtoconic.

Remarks: Powell (1964, 1966) differentiated two subgenera, *Lophiotoma* and *Lophioturris*, which were raised to full generic status by Oyama (1966). In *Lophiotoma* s.s. the protoconch was described as conical and ribbed, with 3½–4 whorls, whereas in *Lophioturris* it was said to be blunt, smooth and paucispiral, with 1½ whorls. However, geographic variation within *L. indica*, type species of *Lophioturris*, seems to transcend this subdivision. In Queensland specimens, for example, the protoconch is bluntly domed, with only about two whorls, the axial ribs being restricted to part of the last one (Fig. 4). However, in southern African individuals of *indica* (Fig. 5) the conical protoconch consists of nearly 3 whorls, and the axial ribs commence on the penultimate whorl. Separation of two *subgenera* on stated grounds is clearly unsupportable. The possible significance of this difference is discussed further under *L. indica.*

Xenuroturris Iredale, 1929, is another taxon that must be referred here. Powell (1966) separated it from *Lophiotoma* solely by its somewhat truncated base. This character *(inter alia)* was also used to distinguish *Annulaturris* from *Turris*, and in the Hawaiian *Gemmula gemmuloides* (Powell, 1967) misled its describer into referring the species to *Xenuroturris*, although it is otherwise a perfectly typical *Gemmula*. Use of a single obviously convergent or parallel character-state as a generic criterion is probably ill-advised, and *Xenuroturris* warrants (at most) subgeneric status. The protoconch of the type species resembles that of *Gemmula* in its pupoid shape and fine axial ribbing.

Key to the species of *Lophiotoma* in southern Africa and Mozambique

1	Aperture about half total length; shoulder sulcus a narrow groove	**cingulifera**
–	Aperture about one-third total length; shoulder sulcus an evenly curved concavity	2
2	Peripheral (sinus) ridge a sharp bifid keel	**acuta**
–	Peripheral (sinus) ridge neither prominent nor bifid	**indica**

Subgenus *Lophiotoma* s.s.

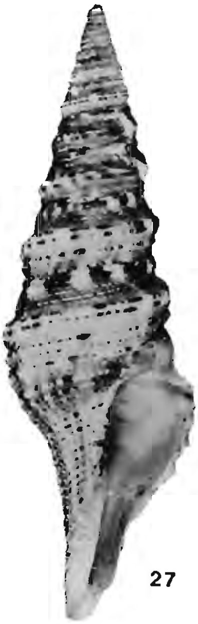
Lophiotoma (Lophiotoma) acuta (Perry, 1811). Figs 27, 29

Pleurotoma acuta Perry, 1811: pl. 54, fig. 5. Type locality unknown.
Turris acuta; Barnard, 1958: 103, fig. 6.
Lophiotoma acuta; Powell, 1964: 303, pls 180, 232 (left fig., protoconch), 233, 234 (references and synonymy, in part); *idem*, 1966: 14, text-fig. 43 (radula).

Range: Western Pacific to Durban.

Regional locality records: NORTHERN MOZAMBIQUE: Port Amelia (NM J4093: Mrs E. Roscoe); Memba Bay, gravelly sand with *Thalassodendron*, LST to 4 ft above (NM H748, H751–2: K. Grosch); Nacala Bay, sandy area, some *Thalassodendron*, 3 ft above LST (NM H747: K. Grosch); Lunga Bay, gravelly sand with mud, some *Thalassodendron*, 3 ft above LST (NM H745: K. Grosch); Conducia Bay, gravelly sand with *Thalassodendron*, inside reef, 1–3 ft above LST (NM H743, H749: K. Grosch), sandy area above reef, with *Thalassodendron*, 1 ft above LST (NM H744: K. Grosch), muddy *Thalassodendron* near sandflats, 2 ft above LST (NM H750: K. Grosch); Mozambique Island (NM F6314: P. Elston); Mozambique Bay, edge of sandflat near *Thalassodendron*, 4 ft above LST (NM H746: K. Grosch). NATAL: Durban (NM 574, 597, 598: H. C. Burnup; NM B2358: B. J. Young, from harbour dredgings); off Durban, *ex pisce* (NM 5142: H. Bell-Marley).

Remarks: Powell (1964) overlooked records of *L. acuta* from Natal. It is locally very rare, the preferred habitat of sheltered banks of coarse sand evidently restricting the Natal population to Durban Bay, where eventual extinction is almost inevitable. Offshore populations have not yet been located, and no live examples have been seen for many years.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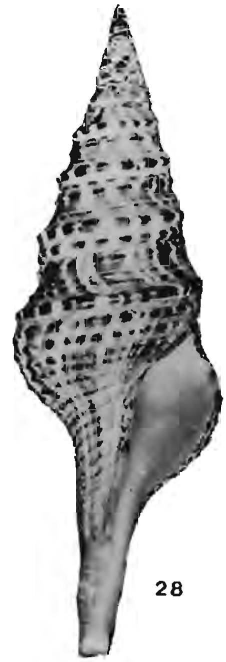
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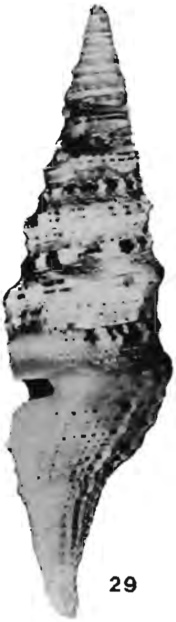
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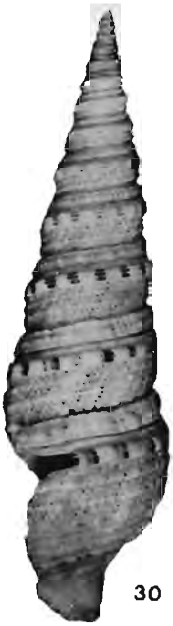
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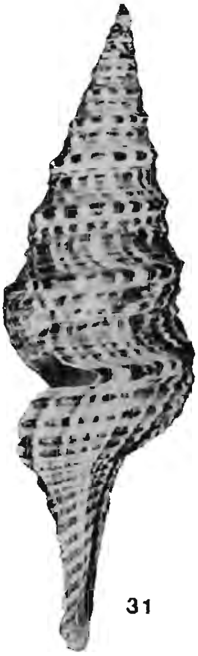
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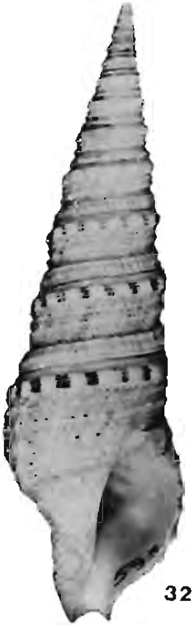
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Figs 27–32. *Lophiotoma* species: 27, 29, *L. acuta* (Perry, 1811), off Durban, *ex pisce*, 54,5 × 17,1 mm; 28, 31, *L. indica* (Röding, 1798), off Mbotyi, Transkei, 60–70 m, 51 × 16,7 mm; 30, 32, *L. (Xenuroturris) cingulifera* (Lamarck, 1822), Durban, 56,1 × 16,8 mm.

Pleurotoma notata Sowerby, 1888, regarded as a synonym of *L. acuta* by Powell (1964), was recognised as a valid species by Oyama (1966: 14). Japanese specimens (NM G3843, J3689) confirm the latter view.

Lophiotoma (Lophiotoma) indica (Röding, 1798). Figs 4–5, 28, 31

Pleurotoma indica Röding, 1798: 124 (type-figure Chemnitz, 1780: pl. 145, figs 1345, 1346). Type locality unknown [= Tranquebar, India, fidé Chemnitz, 1780: 187].
Turris indica; Barnard, 1958: 105, figs 3g (radula), 6b (protoconch); *idem*, 1969: 603.
Lophiotoma (Lophioturris) indica; Powell, 1964: 311, pl. 175, figs 2, 3, 9, 16, pl. 232, right fig. (protoconch), pl. 242, fig. 1; *idem*, 1966: 14, text-fig. 44 (radula).

Range: Western Pacific to Transkei.

Regional locality records (unlocalised material omitted): CENTRAL MOZAMBIQUE: off Beira, trawled (NM H8532: B. J. Young). SOUTHERN MOZAMBIQUE: off Inhaca Is., 160 fath. (NM G4945: A. Ramalho). Zululand: Off Cape Vidal and Neill Peak, 55–100 fath., and off Tugela River, 40–73 fathoms (Barnard, 1958). NATAL: S.E. of Tongaat, 120–150 fath. (NM 9913: G. Scott); off Durban, 100 m, very fine muddy sand (NM B5880: *MN*) and 150 fath. (NM A2071: Mrs G. Webber). TRANSKEI (all fine mud, with worm-tubes): off Waterfall Bluff, 80–90 m (NM C750: *MN*); off Mbotyi, 60–70 and 80 m (NM C358, C405: *MN*); off Umgazi; 92 and 100 m, coarse sand and rubble (NM C1846, C1852: *MN*); off Mzimhlava River, 50 m (NM C771: *MN*); off Rame Head, 70 m, mud, shell debris (NM C1915: *MN*); off Stony Point, 70 m, sand with mud lumps (NM C4306: *MN*).

Notes: Powell (1964) overlooked the occurrence of *L. indica* in the western Indian Ocean. It is common off Natal and Transkei in soft black mud from 50 to 275 metres depth. Pure white shells (*bulowi* Sowerby, 1888) have been trawled off Natal and Mozambique.

The striking difference, noted above, between the protoconchs of Queensland and South African individuals (Figs 4, 5, and compare also Powell, 1964, pl. 232, with Barnard, 1958, Fig. 6b), may be geographic in basis but may also conceivably be influenced by larval ecology. In Queensland the species is said to be a sand-dweller ('intertidal sand flats often among weed patches' (Coleman 1981: 244) and NM labels), whereas local populations inhabit soft muddy silt. Under such muddy conditions pelagic development (as suggested by protoconch characters) would not only provide access to the organically-rich overlying waters, but would also reduce the period during which the developing eggs would be vulnerable to burial by the unstable, partly anaerobic substrate.

Subgenus *Xenuroturris* Iredale, 1929

Xenuroturris Iredale, 1929: 285. Type species (o. d.) *X. legitima* Iredale, 1929 [= *Pleurotoma cingulifera* Lamarck, 1822].

Lophiotoma (Xenuroturris) cingulifera (Lamarck, 1822). Figs 6, 30, 32

Pleurotoma cingulifera Lamarck, 1822: 94; Sowerby, 1897: 2. Type locality unknown. [= Mauritius, designated Powell, 1964].
Turris cingulifera; Barnard, 1958: 103, fig. 6a (protoconch).
Xenuroturris cingulifera cingulifera; Powell, 1964: 322, pl. 175, figs 12, 19, 20.

Range: Tropical Pacific Ocean to Natal south coast.

Regional locality records: NORTHERN MOZAMBIQUE: Quirimba Is. (NM G3944: A. Jenner); Port Amelia (NM J4091: Mrs E. Roscoe); Memba Bay, depression in sandflat with *Thalassodendron* and some mud, and in gravelly *Thalassodendron* near rocks, 3 ft above LST (NM H761, 762: K. Grosch); Lunga Bay, soft sand with rocks, some surf, current, LST, and sandy area with some mud, near *Thalassodendron* and rocks (NM H756, 757: K. Grosch); Nacala Bay, fine sand. *Thalassodendron*, some mud, rocks (NM H760: K. Grosch); Mozambique Island, muddy sand among *Thalassodendron*, above coral (NM H758: K. Grosch); Conducia Bay in muddy sand or sandy mud, usually with rocks or *Thalassodendron*, LST to 3 ft above (NM H763, 764, 759, 5594, 5595: K. Grosch). SOUTHERN MOZAMBIQUE: Bazaruto Is. (NM G3941, J4092: Mrs E. Roscoe). ZULULAND: Ledsman Shoal, 100 m (NM B4024: A. Connell); 6 mi. S. of Sodwana, 40–50 m (NM B4889: A. Connell). NATAL: Durban (NM 6600: R.K; NM 593, 595, 6603: H. Burnup; NM 6602: W. Falcon; NM B2412–4: B. J. Young); Aliwal Shoal, 40–60 ft (NM B3510: A. Connell).

Remarks: In the tropics this species lives in muddy sand among rocks at and above low-tide level, where protected from surf. At the turn of the century it evidently could be collected in similar situations near the entrance to Durban Bay, but at present in Natal lives entirely offshore.

Powell (loc. cit.) incorrectly claimed that western Indian Ocean material attained a smaller maximum size than Pacific populations. A broken Durban shell measures 63 mm in length, while a Conducia Bay specimen of 72,6 × 20,2 mm in fact exceeds Powell's largest Pacific example in dimensions.

Gemmula Weinkauff, 1875

Gemmula Weinkauff, 1875: 287. Type species (s.d. Cossmann 1896) *Pleurotoma gemmata* Reeve, 1843 (*non* Conrad, 1835) [= *G. hindsiana* Berry, 1958].

Diagnosis: Anal sinus on peripheral keel, which is strongly gemmate; protoconch pupiform, axially costate, of 3–4 whorls.

Notes: Shuto (1975: pl. 7, fig. 15) has illustrated the protoconch of the West American type species, *G. hindsiana*, and McLean (1971: fig. 27) gave a photograph of its radula. Oyama's statement (1966: 1) that the radula of *Gemmula* 'consists of marginals only' is erroneous, as most members of the genus (including the type species) appear to possess a rachidian plate.

Published studies on *Gemmula* have been rather superficial, species being often compared only at the level of general shape, colour and coarseness of sculpture. It should be realised that small sculptural details and size of protoconch may be equally important characters in distinguishing species.

South African *Gemmula* species have hitherto been lumped together under the name *G. gilchristi* (Sowerby 1902), a much misunderstood taxon. Eight species are here recognised for the southern African region, 5 of which have previously been recorded only from the western Pacific.

Powell (1964, 1966) utilised *Undedogemmula* MacNeil, 1960, as a subgenus for species in which the peripheral gemmules become obsolete on the later whorl, but this taxon seems closer to *Lophiotoma*. No members of *Unedogemmula* are known from southern Africa. On the other hand, two other closely-allied taxa, *Pinguigemmula* and *Ptychosyrinx*, which are regarded by Powell as full genera, do occur. These differ from *Gemmula* only in small degree and are here treated as subgenera, which may be keyed out thus:

1 Anal sinus narrowly U-shaped .... **Gemmula**

– Anal sinus broadly and openly U-shaped 2

2 Broadly fusiform with abruptly contracted base and long canal **Pinguigemmula**

– Narrowly fusiform with short siphonal rostrum .... **Ptychosyrinx**

Key to the species of *Gemmula s.s.* in southern Africa and Mozambique

1 Subsutural cord subequal in width to shoulder sulcus or wider than it; peripheral cord normally marked with brown or yellow 2

– Subsutural cord distinctly narrower than shoulder sulcus; peripheral cord not patterned 4

2 Main spiral ridges distinctly granulose; granules and gemmae with vivid brown interstices; relatively large (up to 4–6 cm), protoconch diameter 1,5 mm ... 3

– Ridges (other than peripheral cord) not granulose; peripheral cord with irregular brown or yellowish blotches; small (up to 3 cm), protoconch diameter 1,25 mm .... **rarimaculata**

3 Aperture 0,45–0,48 total length; spire whorls with 2 basal cords; shoulder sulcus broader than subsutural cord, without a 'false suture', true suture narrowly canaliculate; spire orthoconic .... **kieneri**

– Aperture 0,36–0,38 total length; spire whorls usually with only 1 basal cord (rarely two); shoulder sulcus more or less narrower than subsutural cord, which is often bordered below by a suture-like furrow; true suture deep, but not canaliculate; spire slightly cyrtoconic .... **webberae**

4 Basal periphery of body whorl with 3 main cords, followed by an unbroken sequence of fine basal and rostral lirae; gemmate cord forming a prominent shoulder; large (attaining 5–6 cm); protoconch diameter 1,4 mm; shell white, usually with a brownish subsutural cord .... **cosmoi**

– Basal periphery with 3–4 main cords, separated by a zone of fine basal lirae from the differentiated sequence of slightly stronger rostral ones that follow; whorls not strongly shouldered; rarely exceeding 4 cm in length; protoconch 1,25 mm or less in diameter; shell usually tinged with brown or buff........ 5

5 Shell narrow (breadth/length 0,29) with a slender, bent siphonal rostrum; gemmae forming dense, lunulate plicules from penultimate whorl onwards; basal periphery of body whorl with 3 main cords .... **championi**

– Shell broader (breadth/length 0,30–0,36), siphonal rostrum wider and straighter; gemmae becoming pliculate only behind lip; basal periphery with 4–5 main cords 6

6 Subsutural cord consisting of a single thin keel, with an inconspicuous second thread; protoconch diameter 1,25 mm; gemmae flat-topped in side view .... **monilifera**

– Subsutural cord bicarinate; protoconch diameter 0,8–1,1 mm; gemmae shallowly bifid (notched) in side view 7

7 Suture not channelled; gemmate cord bordered anteriorly by a series of inconspicuous punctae; crest of main subsutural ridge shallowly bifid; almost uniform brown .... **rosario**

– Suture channelled; gemmate cord not bordered by punctae, crest of main subsutural ridge not bifid; white, usually tinged with buff .... **gilchristi**

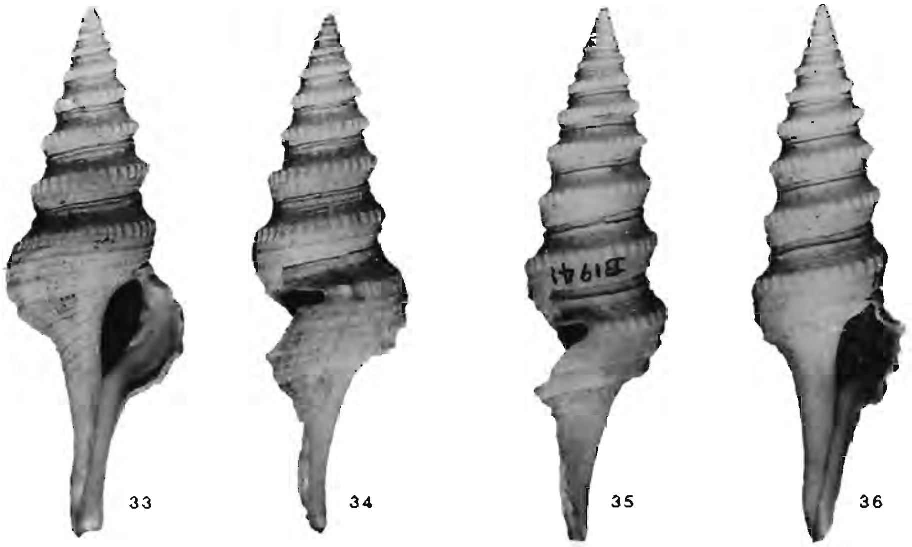
Subgenus *Gemmula* s.s.

Gemmula (Gemmula) cosmoi (Sykes, 1930). Figs 8, 14, 33–36

Turris cosmoi Sykes. 1930: 82, text-fig. Type locality: Kii, Japan.
Gemmula congener cosmoi; Powell, 1964: 252, pl. 192.
Gemmula cosmoi; Oyama, 1966: 10.

Diagnosis: Adult shell length 4–6 cm, aperture 0,43–0,48 of total length, rostrum longer than rest of aperture; subsutural cord weak, bicarinate, shoulder sulcus wide, shallow, declivously concave; peripheral cord forming prominent median angle to whorls, with 26–31 coarse gemmae per whorl, intervals between gemmae with 2–3 weak spiral threads; basal periphery of body whorl with 3 main spiral cords, separated by a zone of weaker threads from the basal/rostral series of lirae. White, subsutural cord usually brownish-orange. Protoconch diameter about 1,4 mm. Rachidian plate transversely rectangular with slender mesocone.

Description: Shell with relatively long siphonal rostrum, usually longer than rest of aperture, aperture 0,43–0,48 of total length; suture narrowly but distinctly channelled, spire slightly cyrtoconic, whorls with a strong median angle; about 10 teleoconch whorls. Subsutural cord weak and rather inconspicuous, bicarinate, the lira at the suture being usually the weaker. Peripheral cord prominent, much



Figs 33–36. *Gemmula cosmoi* (Sykes, 1930): 33, 34, broad form, 62,7 × 20,9 mm; 35, 36, narrow form, 64,1 × 18,4 mm. Both trawled off Tongaat, Natal.

stronger than subsutural cord; anal sinus typical; gemmae relatively coarse, slightly prosocline, 26–31 on penultimate whorl, becoming low and lunulate towards lip, their crests very shallowly bifid, their intervals crossed by 2–3 feeble spiral threads. Shoulder sulcus shallowly concave and declivous, wider than subsutural cord (3–4 times as wide on later whorls), with 3–6 thin sharp spiral threads, sometimes with weaker intermediaries. Basal periphery of body whorl with 3 strong cords (two of which are visible on spire whorls), with 2–4 fine spiral threads in each interval; peripheral cords separated from ridges on rostrum by a series of weaker threads. Ground colour white, lirae of subsutural cord often tinged with brownish-orange.

Protoconch (Fig. 8) always more or less eroded, about 4 whorls, last 2–3 with arcuate axial ribs, numbering about 14 on final whorl; colourless; maximum diameter about 1,4 mm.

Dimensions: 63,9 × 18,4 mm; 62,8 × 21,1 mm.

Radula (Fig. 14): Rachidian plate diaphanous, transversely rectangular, with acicular mesocone, marginal plates typical of *Gemmula*.

Range: Japan to northern Natal.

Regional locality data: SOUTHERN MOZAMBIQUE: Off Bilene, 160 fathoms (NM G4953: A. Ramalho); off Maputo, 270 fathoms (NM F6948: Mrs K. Eastwood); off Inhaca Island, 250 fathoms (NM 5661: Mrs K. Eastwood). NATAL: Off Tongaat, 150 fathoms (NM B5516: G. Scott).

Notes: *Gemmula cosmoi*, supposedly a Japanese endemic, is locally common on muddy parts of the continental slope in 270–490 metres. N.M. material from Japan and Taiwan agrees well with local shells, and the radula of a Tongaat specimen matches unpublished figures of the radulae of two Japanese examples, very kindly made available to me by Dr Masao Azuma.

Powell (1964, 1967) treated *cosmoi* as the Japanese subspecies of the northern Indian Ocean *Gemmula congener* (E. A. Smith, 1894). Further subspecies were ascribed to Hawaii (*unilineata* Powell, 1967) and the Philippines (*diomedea* Powell, 1964), where the nominate subspecies was also said to occur. However, Powell (1966: pl. 11, Fig. 51) illustrated the radula of *diomedea* from Indonesia as possessing a degenerate rachidian plate, quite unlike the rectangular, unicuspidate rachidian of *cosmoi* from Japan and southern Africa. Certainly, *diomedea* and *cosmoi* cannot be regarded as conspecific. To complicate the matter further, Powell's interpretation of *G. congener s.s.* does not agree well with the type figures of that taxon. Smith (1894: pl. 3, Figs 5, 6) illustrated a somewhat *cosmoi*-like shell, but with tabulate gemmae separated by brown flecks, a more cyrtoconic spire, a slightly stronger subsutural cord and a relatively short siphonal rostrum. Powell illustrated as *congener* a species with massive subsutural cord and furrow-like shoulder concavity, comparable rather with *G. rarimaculata*.

No specimens of true *G. congener* (nor the Hawaiian *unilineata*) have been seen by me, and its relationships are unknown. Consequently *Gemmula congener webberae* Kilburn, 1975 (see below), is best treated as a full species. Its square rachidian plate with prominent mesocone differs markedly from that of *G. cosmoi* and *diomedea*.

The question of whether the Sino-Japanese and Natal–Mozambique populations of *G. cosmoi* are truly isolated also remains to be resolved. In all probability the species will sooner or later be discovered at intervening localities.[1]

Gemmula (Gemmula) webberae Kilburn, 1975, **stat. rev.**

Gemmula congener webberae Kilburn, 1975: 600, figs 13 (radula), 14. Type locality: off Durban in about 150 fathoms.

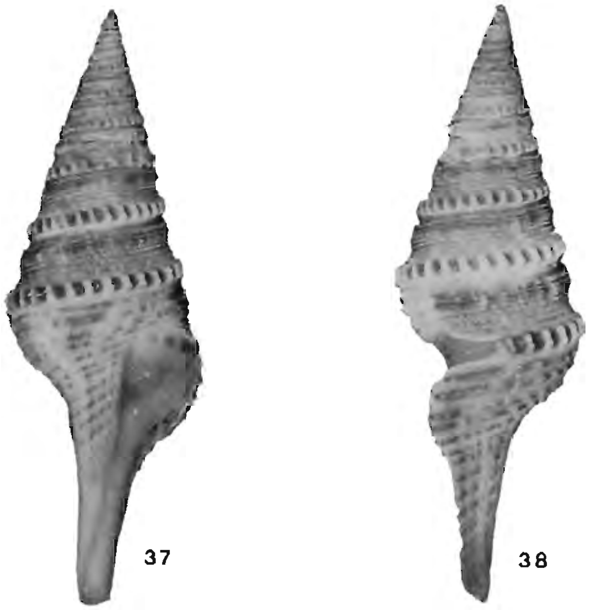
Notes: Reasons for now regarding this taxon as a full species are given under *Gemmula cosmoi* (above). In the original description I omitted to mention that the maximum diameter of the protoconch is 1,5 mm.

Additional material: off Durban, 165 m, fine muddy sand (NM B5885: *MN*), 195 m, slightly muddy sand (NM B5907: *MN*) and 270 m, very fine sand (NM B5914: *MN*).

Gemmula (Gemmula) kieneri (Doumet, 1840). Figs 7, 13, 37–38, 40

Pleurotoma kieneri Doumet, 1840: 2, pl. 10. Type locality unknown.
Gemmula kieneri; Powell, 1964: 246, pl. 186, figs 2, 3; Oyama, 1966: 10 (references).

Diagnosis: Shell attaining 5 cm, aperture 0,45–0,48 total length, sutures narrowly channelled; subsutural cord weaker than shoulder cord, with 3–4 lirae; peripheral cord moderately projecting with 23–31 shallowly bifid gemmae, their intervals with 2 very weak spiral threads; shoulder sulcus evenly concave, subequal to sub-



Figs 37–38. *Gemmula kieneri* (Doumet, 1840), off Waterfall Bluff, Transkei, 80–90 m, 45,3 × 15,3 mm.

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[1] Since this was written, a specimen from off Luzon Is., Philippines (NM J5597: F. J. Springsteen) is to hand.

sutural cord in width; basal periphery of body whorl with 4 main cords; all main spiral ridges granulose, growth striae coarse. Whitish with subsutural cord and intervals between both gemmae and granules orange-brown. Protoconch diameter 1,5 mm. Radula as in *G. cosmoi.*

Description: Shell with 9–10 teleoconch whorls, aperture slightly shorter than spire (0,45–0,48 total length); spire more or less orthoconic, sutures narrowly channelled. Subsutural cord moderately strong, bearing 3–4 crenulate spiral ridges, the lower or penultimate one the strongest, the ridge bordering the suture being very thin and rather cristate. Peripheral cord markedly stronger than subsutural one, but not forming a prominent shoulder angle; gemmae prosocline, with shallowly bifid, angular crests, 23–31 on penultimate whorl, becoming weak and imbricately lunulate just behind labrum; intervals with 2 feeble spiral threads. Shoulder sulcus evenly concave, subequal in width to subsutural cord, bearing 3–4 thin, rather high spiral lirae, rendered crenulate by growth threads. Body whorl with 4 main cords at periphery of base, separated by groups of 1–4 fine intermediary threads; 1 main cord visible on spire whorls; basal lirae becoming progressively finer on rostrum, alternately more or less weaker and stronger, crossed by thread-like growth lines. All main spiral ridges distinctly granulose.

Ground colour white to yellowish-white, intervals between gemmae and between granules on basal cords dark orange-yellow to deep yellowish-brown, subsutural region blotched with the same colour.

Protoconch (Fig. 7) of about 4 pale yellowish whorls; axial riblets commence on penultimate whorl, where opisthocline; on last whorl thin, arcuate, prosocline and about 19 in number; maximum diameter 1,5 mm.

Radula (Fig. 13): Rachidian transversely rectangular with very prominent mesocone.

Dimensions: 48,8 × 16,7 mm; 45,3 × 15,7 mm; 40,6 × 14,1 mm.

Distribution: South China Sea and Queensland to Natal and Transkei.

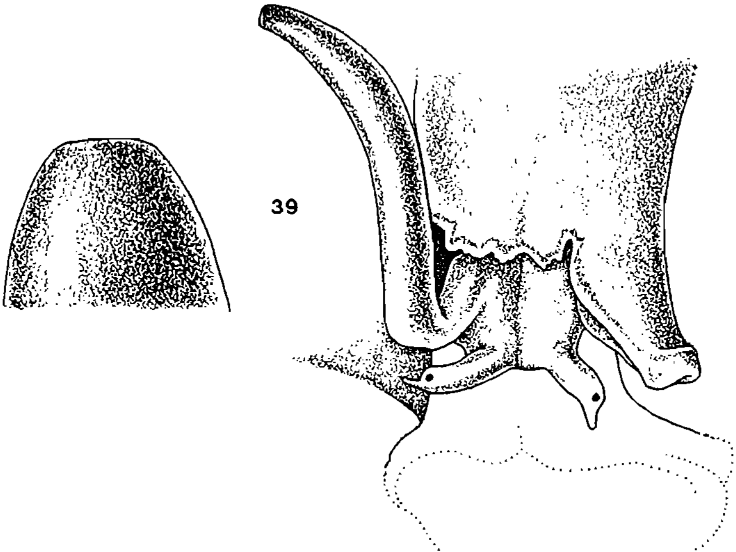
Regional locality data: ZULULAND: Off Kosi Bay, 100 m (NM B3001: A. D. Connell); Ledsman Shoal, 100 m (NM B3101: A. D. Connell). NATAL: Off Durban, 100 m, very fine muddy sand (NM B5877: *MN*); off Park Rynie, sponge-rubble, 136 m (NM B3905: *MN*) and 110 m (NM B3541, B3847: *MN*); off Port Shepstone, 70 m, eroded shell and sponge-rubble (NM B3613: *MN*). TRANSKEI: Off Mtamvuna River, 100 m, large sponges, rubble (NM C5466: *MN*); off Mzamba, 100 m, sponge-rubble (NM C5259: *MN*); off Waterfall Bluff, 80–90 m, fine mud with worm-tubes (NM C752: *MN*); off Rame Head, 100 m, old shell-conglomerate (NM C1826: *MN*); off Bulungula River, 90 m, muddy sand (NM C1831: *MN*).

Notes: Although Powell (1964) ascribed to *G. kieneri* a restricted range of 'Japan, China and the Philippines', the NM also has specimens from Queensland (off Cape Moreton, 80 fathoms, NM J4066: D. & V. Harris), and material from the Natal and Transkei shelf is indistinguishable from Eastern shells. Kensley (1973: Fig. 801) evidently figured this species as *Turris gilchristi*, using a specimen identified by Barnard, and Powell (1964: pl. 189, Figs 1, 2) appears to have made an identical error. Ladd (1982: 60) reports *G. kieneri* from the Pleistocene of the New Hebrides, and its Pliocene subspecies *woodwardi* (Martin, 1884) from Fiji.

Powell (loc. cit.) showed *Pleurotoma kieneri* to be the correct name for *Gemmula granosa* auctt., *non* Helbling, 1779, which he regarded as indeterminate. However, Helbling's figure, as reproduced by Powell (1964: pl. 118, Fig. 1), appears to be a representation of the Pacific cochlespirinid better known as *Vexitomina regia* (Reeve, 1842). The latter species should probably be called *V. granosa* (Helbling, 1779).

Gemmula kieneri inhabits the outer continental shelf in 70–136 m, on various substrata. It is evidently replaced on the continental slope by the superficially similar *G. webberae* (Kilburn, 1975), which is less biconical with a shorter siphonal rostrum and less strongly shouldered periphery; other differences are given in the key.

The termination of the penis in the only male *G. kieneri* examined (Fig. 40) bears a small papilla, not observed in any other member of the Turrinae studied



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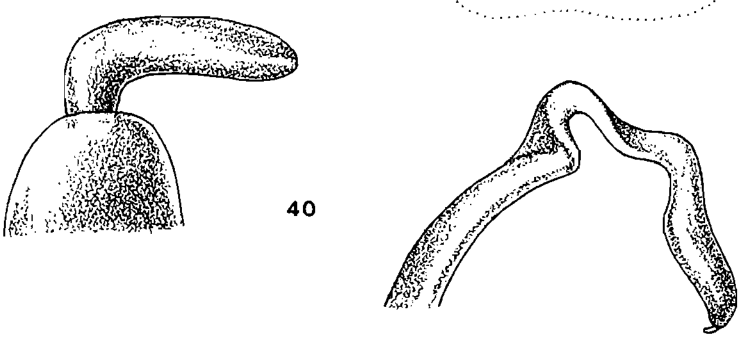

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Figs 39, 40. (39) Penis of *Turris ruthae* and (40) terminal third of penis of *Gemmula kieneri*, with tip magnified.

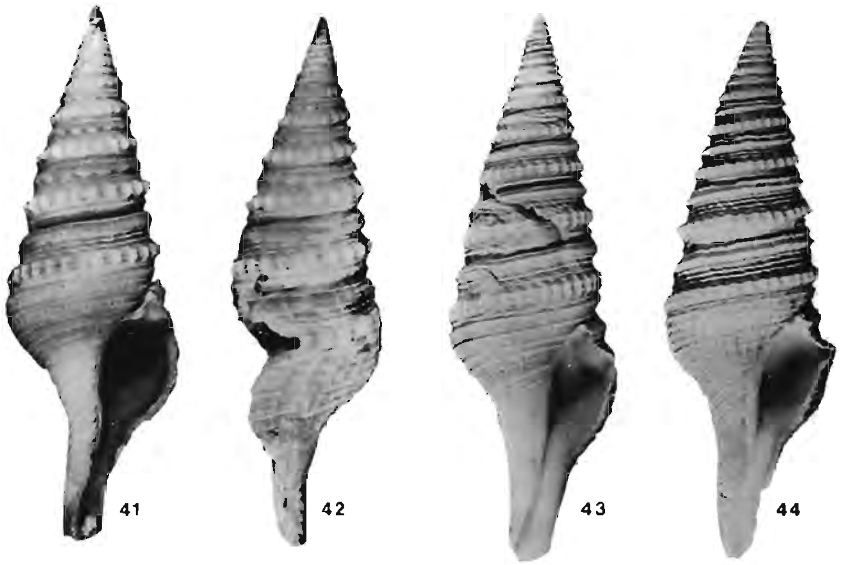
(G. cosmoi, Turris ruthae, Lophiotoma indica); the organ itself is longer and more slender than in the latter three species.

Gemmula (Gemmula) gilchristi (Sowerby, 1902). Figs 8, 16, 41–44

Pleurotoma gilchristi Sowerby, 1902: 99, pl. 2, fig. 9. Type locality: off Tugela River, 55 fathoms.
Turris gilchristi [partim]; Barnard, 1958: 106, fig. 3h (radula), ? 6d (protoconch).
Gemmula gilchristi (pars); Powell, 1964: 249.

Diagnosis: Shell 3–4 cm long; aperture 0,38–0,44 total length: sutures narrowly channelled; subsutural cord nearly as strong as shoulder cord, bicarinate, sometimes crenulated; shoulder cord rather weak, with 20–33 shallowly bifid gemmae, their intervals with 2 weak spiral threads; shoulder sulcus subequal in width to subsutural cord; basal periphery of body whorl with 4 main spiral cords (rarely more), separated basally by a narrow zone of fine lirae from a slightly stronger series that extends on to rostrum. White, usually tinged with light brown. Protoconch diameter 0,8–1,0 mm. Radula without rachidian plates.

Description (typical form): Shell with siphonal canal subequal to or slightly shorter than rest of aperture, aperture 0,38–0,43 of total length; spire orthocline with very acute apex and narrowly channelled suture; teleoconch whorls about 10½. Subsutural cord nearly as strong as shoulder cord, bicarinate with a thin subsutural ridge and angular main one. Shoulder cord only moderately projecting, with rather low gemmae, 20–28 on penultimate whorl, their crests shallowly bifid and their intervals with two weak spiral threads; on back of body whorl gemmae become flattened and lunulate. Shoulder sulcus subequal to subsutural cord in width, shallowly and evenly concave, bearing 3–5 thin spiral threads. Basal periphery of body whorl with 4 main spiral ridges, separated by intermediaries of



Figs 41–44. *Gemmula gilchristi* (Sowerby, 1902): 41–42, holotype, 32 × 10,4 mm; 43, off Mbotyi, Transkei, 100 m, 35,2 × 10,7 mm; 44, off Mozambique, 37,3 × 12,2 mm, 43 and 44 whitened with ammonium chloride.

varying strength; base with alternately weaker and stronger lirae, becoming progressively finer on rostrum, with one sutural lira markedly stronger than its successors, and separated from peripheral cords by a finely lirate gap. Axial striae fine and somewhat pliculate.

White, body whorl and subsutural region tinged with light brown.

Protoconch (Fig. 10) small, pupoid-conic, about 4 whorls, axial ribs commencing on penultimate whorl, where they number about 17; white; diameter 0,8–1,0 mm.

Dimensions: 32 × 10,4 mm (holotype); 35,2 × 10,7 mm; 29,7 × 9,8 mm. Deep water form: 39,4 × 12,5 mm, 39,6 × 12,3 mm.

Radula (Fig. 16) without rachidian plates.

Distribution: Continental shelf from Zululand to East London area, in about 80–130 m (typical form).

Material examined: ZULULAND: Off Tugela River, 55 fathoms (holotype, BM(NH) 1902.5.28.44). NATAL: Off Durban, 150 fath. (NM 9910: G. Scott). TRANSKEI: Off Mbotyi, 100 m, soft mud (NM C548: *MN*); off Port Grosvenor, 120–128 m, coarse sand, some mud (NM C1137: *MN*); off Waterfall Bluff, 80–90 m, fine mud, worm-tubes (NM C753: *MN*); off Ubombo, 80 m, mud and sand, shell debris (NM C3828: *MN*). EASTERN CAPE: off Hood Point, East London, 49 fath. (SAM A8676: ss *Pieter Faure*). Also: off Mozambique, trawled (NM F7287: R. Cruickshank); off Natal/Zululand (NM B2968: Tvl. Mus. colln., ex SAM).

Notes: Few turrids have been as widely misinterpreted as *Gemmula gilchristi*. For example, Barnard (1958), who apparently believed the gemmate peripheral cord to be a specific rather than a generic character, united examples of several different species under this name. Powell (1965) ascribed to *G. gilchristi* a wide Indo-Pacific range, yet figured for it what appears to be *G. kieneri*, while his reference to uniformly-coloured, shallow-water examples probably applies to *G. rosario*. Oyama (1966) regarded Powell's record of *gilchristi* from Japan as being based on *G. husamaru* (Nomura, 1940). Powell's figure (1966: C53) of the radula of a Sunda Strait specimen ascribed to *gilchristi* shows a rachidian plate and is obviously also misidentified. Clearly, acceptance of extralimital records must await careful re-examination of actual specimens.

G. gilchristi lacks striking characters and is distinguished by a combination of features such as a relatively minute protoconch, channelled suture, and rather weak shoulder cord with numerous (20–28) gemmae. The formal description given above is based on the typical form, which inhabits muddy substrata on the continental shelf in 80–128 metres. However, a distinctive bathymorph (Fig. 44) inhabits the continental slope in about 275 m. When more material is available this will probably prove to be a distinct species. It differs from typical *gilchristi* (Figs 41–43) in its larger size (attaining about 14 cm), slightly longer aperture (0,43–0,44 of total length), slightly larger protoconch (diameter 1,1 mm), more projecting peripheral keel, bearing 30–33 gemmae, with deeply bifid interstices, on the penultimate whorl, a crenulate subsutural cord, sometimes bearing a third lira, shoulder sulcus often deeper, peripheral ridges more irregular (4–6 stronger than others, although not markedly so), growth striae stronger, and overall colour white or greyish-white. Unfortunately, few specimens are known, only one with precise locality data. This form/species is evidently trawled together with *G. cosmoi.*

Gemmula (Gemmula) rosario Shikama & Hayashi, 1977, Figs 11, 17, 45–47

Pleurotoma monilifera (*non* Pease, 1860); Sowerby, 1897: 2.
Gemmula rosario Shikama & Hayashi, in Shikama, 1977: 18, pl. 3, figs 11a, b. Type locality: Kii Channel, Japan, 100–150 m.

Diagnosis: Shell length about 4,5 cm, aperture 0,38–0,45 total length, suture not distinctly channelled; subsutural cord bicarinate, crest of second ridge very slightly bifid; peripheral cord rather weak, gemmae relatively small and close, bifid, 36–48 on penultimate whorl; each gemma terminates below in a short tail which subtends a slight punctation; shoulder sulcus very shallow, wider than subsutural cord; basal periphery of body whorl as in *gilchristi.* Colour uniform or mottled yellowish-brown. Protoconch diameter 0,8–1,1 mm. Radula without rachidian plates.

Description (Natal population): Shell with aperture 0,38–0,45 of total length; spire orthoconic to slightly cyrtoconic; sutures not distinctly channelled; about ten teleoconch whorls. Subsutural cord bicarinate with a thin, non-cristate lira at suture and a main ridge whose crest is faintly bifid, the two ridges usually being separated by a fine intervening thread. 'Peripheral' cord rather weak, sometimes not even projecting to level of actual periphery of body whorl; gemmae relatively small and close-set (numbering 36–48 on penultimate whorl) and crenulating edges of shoulder cord; each gemma ends below in a short prosocline 'tail' which subtends a slight punctation. Shoulder sulcus barely impressed, wider than subsutural cord, with 4–5 thin spiral lirae. Basal periphery of body whorl bearing 4 main spiral ridges, 1–2 of which appear on the spire whorls; intervals each with a weaker ridge and several fine spiral striae. Rostrum with numerous spiral threads, becoming progressively finer anteriorly, initially alternately weaker and stronger, with one ridge at base of rostrum markedly stronger than the others. Growth striae relatively weak. Anal sinus typical.

Colour uniformly moderate yellowish-brown.

Protoconch (Fig. 11) conical, 3½ whorls, axial ribs commencing on penultimate whorl, about 19 on last whorl; translucent brownish, diameter 0,8–0,9 mm.

Dimensions (Durban shells): 44,8 × 14,2 mm, 41 × 12,5 mm, 38,5 × 13,1 mm. Japanese specimens: 47,1 × 14,7 mm, 40,3 × 12,1 mm.

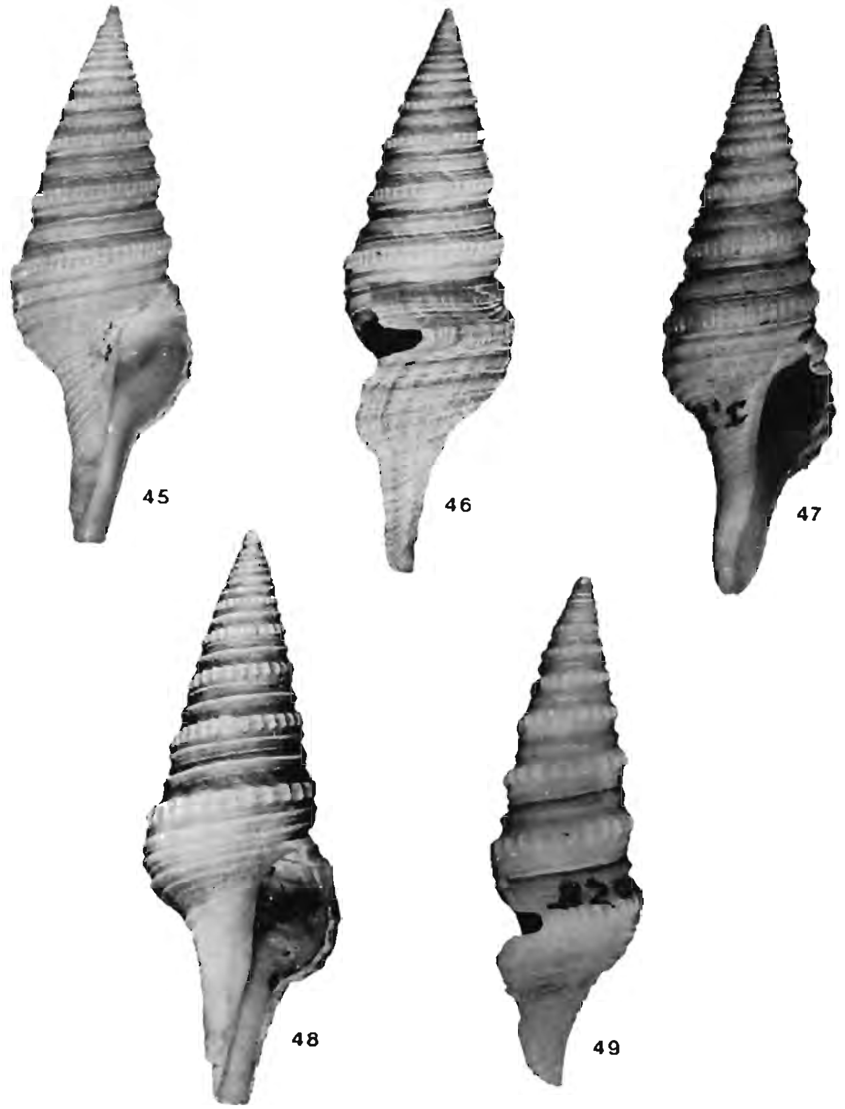
Radula (Fig. 15) consisting of marginal plates only.

Distribution: Japan to Natal.

Regional locality data: NATAL: Durban (NM 4378, 599: H. Burnup; NM 4379: RK; NM B1979, B1980: B. J. Young).

Japanese material examined: Nada-Cho, Wakayama Prefecture, 30–50 fath. (NM G7856, G8684: S. Akita); off Kii, 50 fath. (NM J2974; M. Azuma, also Masao Azuma colln. 16315); off Tosa, 50–70 fath. (M. Azuma colln.).

Notes: Sowerby's 1897 record of *Pleurotoma monilifera* from Durban has been referred by subsequent authors to *G. gilchristi.* However, material collected by



Figs 45–49. *Gemmula rosario* Shikama & Hayashi, 1977, and *G. monilifera* (Pease, 1861). 45–47, *G. rosario*: 45–46, Durban, 37,4 × 12,7 mm; 47, off Kii, Japan, 50 fath., 37,8 × 11,8 mm, 48–49. *G. monilifera*: 48, Durban, 30,1 × 10,6 mm; 49, Durban, 24,8 × 7,9 mm.

Burnup and identified by Sowerby as *monilifera* is characterised by its coffee-brown coloration, non-channelled sutures and weak shoulder cord with numerous gemmae, bordered anteriorly by an inconspicuous line of punctae. These specimens agree well with Japanese material distributed under the M/S name '*Gemmula moniliferoides* Kuroda & Azuma'. The taxon appears to have been validly described under the name *Gemmula rosario* Shikama & Hayashi, 1977, if one may judge by topotypic specimens. Unfortunately the original description and photographs leave much to be desired, and recognition is complicated by some evidently erroneous statements in the description. Thus the protoconch was said to be 'smooth and with 2 volutions', which applies to no known *Gemmula*, and the given figure of 'About 20 spiral ridges' for the body whorl implies selective counting of the coarser lirae only.

Japanese and Natal shells are very similar, and the radula of a Kii specimen (drawing kindly sent by M. Azuma) agrees well with an old Gwatkin slide of a Durban example (NM: M52). Minor shell-differences between the two populations perhaps represent extreme ends of clinal gradients. Durban shells (Figs 45, 46) are uniform yellowish-brown (ISCC-NBS terminology), while Japanese ones (Fig. 47) are heavily suffused with light yellowish-brown on a yellowish-white ground, with a tendency for the main cords to be darker than their intervals, and the rostrum to be uniformly pale. The protoconch in Japanese *rosario* is slightly larger, with a diameter of about 1,1 mm instead of 0,8–0,9 mm. Local shells, known only from Durban, have all been collected littorally, save for a few taken from shallow harbour dredgings. In Japan the species appears to inhabit deeper water (55–100 m).

Gemmula hawleyi (Iredale, 1931) of New South Wales and Queensland (off Gloucester Island, NM J4431: Mrs T. Whitehead) is very similar to *G. rosario*, differing only in its shorter siphonal rostrum and stronger, more cogwheel-like gemmate cord, without bordering punctations.

Gemmula (Gemmula) monilifera (Pease, 1861). Figs 48–49

Turris monilifera Pease, 1861: 398; Kay, 1965: 39 (references), pl. 5, figs 17, 18 (holotype, pl. 8, fig. 7 (protoconch). Type locality: Sandwich Islands [= Hawaii]

Gemmula monilifera; Powell, 1964: 249, pl. 189, figs 3, 4 (holotype); Cernohorsky, 1972: 185, pl. 53, fig. 10; Kay, 1979: 337, fig. 111c (veliconcha), pl. 113 C, D.

Diagnosis: Shell attaining about 2,5–3 cm in length, aperture 0,38–0,45 of total length, suture narrowly channelled in adult, subsutural cord weak, with angular main lira and feeble sutural thread; shoulder cord rather wide with 19–28 strong, angular, flat-topped gemmae, their intervals with two weak spiral threads; shoulder sulcus concave, at least twice width subsutural cord; basal periphery of body whorl as in *gilchristi*. Biscuit-colour with pale gemmae and spiral cords. Protoconch diameter 1 mm.

Description (Durban population): Shell with a narrow, somewhat curved siphonal canal, subequal in length to rest of aperture, aperture 0,38–0,45 of total length; spire slightly cyrtoconic, whorls fairly angular; suture narrowly channelled on later whorls only; about 9 teleoconch whorls. Subsutural cord much weaker than shoulder cord, rendered angular by a thin keel-like main lira, with a second, very weak thread immediately below suture. Shoulder sulcus strongly concave, at least twice width subsutural cord, sulcus with 4–5 thin spiral threads, crenulated by fine collabral threads. Shoulder cord rather wide, with strong gemmae, axially oblong to weakly lunulate in shape, flat-topped in lateral profile, 19–28 on penultimate whorl, becoming weak and irregular on latter part of body whorl, intervals between gemmae rendered squarely to rectangularly concave by two weak spiral threads. Basal periphery of body whorl with four main spiral ridges, separated by weaker intermediary threads; rostrum with alternately weaker and stronger lirae, separated from peripheral cords by a zone bearing 3–4 weak spiral threads.

Colour light brown to moderate orange-yellow, gemmae, main spiral cords and rostrum paler to white.

Protoconch worn in local material, basal diameter 1 mm, same colour as teleoconch.

Dimensions: 30,1 × 10,8 mm; 24,5 × 8,0 mm.

Radula unknown.

Distribution: Hawaii and Fiji to Natal.

Regional locality data: NATAL: Durban Bay, shallow dredgings (NM B2021–3, A1435: B. J. Young).

Notes: Local shells agree well with topotypes of *G. monilifera*, showing the range of the species to be far wider than the literature would suggest, the westernmost records being from Sumatra and Queensland. However, comparison with *Pleurotoma amabilis* Jickeli in Weinkauff, 1875, type locality Massawa, Ethiopia, is desirable. As far as the original description and figures permit judgment, there appears to be some resemblance to *monilifera*. Unfortunately the types of *amabilis* cannot be located in the Weinkauff collection in the Löbbecke-Museum, Düsseldorff (Mr J. Boscheinen pers. comm.) nor are specimens extant amongst the Jickeli material in the Naturhistorisches Museum, Wien (Mr E. Wawra pers. comm.). *P. amabilis* must remain a *nomen dubium*, notwithstanding Powell's application (1964: 261, pl. 200, Fig. 1) of the name to a Gulf of Aden shell; the latter seems to resemble (in so far as I can judge) the type figures of *Gemmula pulchella* Shuto, 1961 (see under *G. championi*, herein).

The five examples of *G. monilifera* examined from Durban were taken from shallow-water dredgings used in harbour reclamation work. All are faded shells with major repaired fractures. According to Burnup material in the Natal Museum, Sowerby's 1897 record of *Pleurotoma monilifera* from Durban was based on *G. rosario* Shikama & Hayashi, 1977 (q.v.).

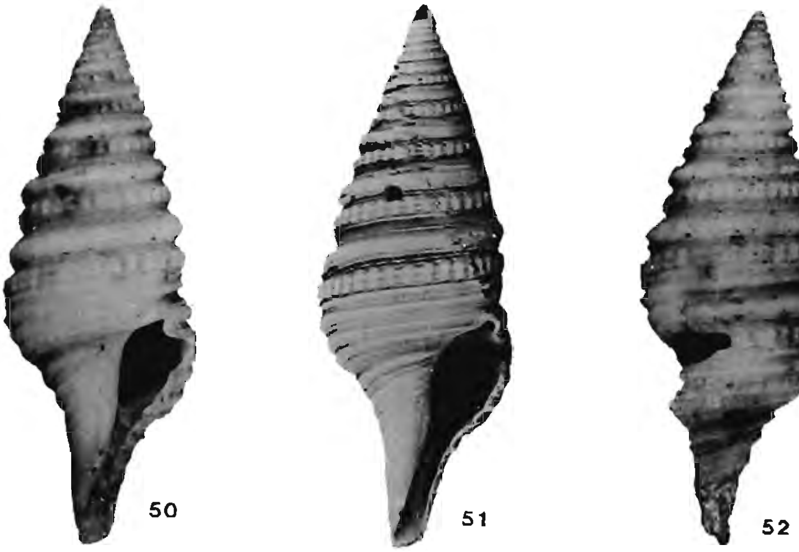
Gemmula (Gemmula) rarimaculata Kuroda & Oyama, 1971. Figs 9, 17, 50–52

Gemmula (Gemmula) rarimaculata Kuroda & Oyama (in Kuroda, Habe & Oyama), 1971: 222, pl. 57, fig. 9, pl. 111, fig. 6. Type locality: Sagami Bay, Japan.

? *Gemmula congener* (*non* E. A. Smith 1894); Ladd, 1982: 60, pl. 18, figs 9, 10.

Diagnosis: Shell length about 2–3 cm, aperture 0,37–0,44 of total length; sutures narrowly channelled; subsutural cord tumid, more or less equal in strength to peripheral cord, bicarinate; shoulder sulcus narrow and sometimes channel-like; peripheral cord with 26–33 close-set, bifid gemmae, their intervals with 2–3 distinct spiral threads; basal periphery of body whorl with 3–4 cords, base as in *gilchristi* but with finer, more numerous lirae. White, peripheral and subsutural cords marked with orange-brown. Protoconch diameter 1,25 mm. Rachidian plate of radula transversely rectangular with sharp mesocone and raised anterolateral corners.

Description (local material): Shell with aperture 0,37–0,44 of total length; spire slightly cyrtoconic, sutures narrowly channelled; about 8 teleoconch whorls. Sub-



Figs 50–52. *Gemmula rarimaculata* Kuroda & Oyama, 1971, off Port Grosvenor, Transkei, 105 m, 23,4 × 8,6 mm. Fig. 51 whitened with ammonium chloride.

sutural cord tumid, usually as strong as peripheral cord, bicarinate, with a thin, finely crenulate, somewhat cristate thread at suture and an angular main ridge. Gemmae on peripheral cord slightly prosocline, bifid, close-set, 26–33 on penultimate whorl, intervals with two rather strong spiral threads. Shoulder sulcus narrow, sometimes canaliculate, with 2–4 threads. Body whorl with 3–4 cords on basal periphery, separated by fine intermediaries, and several more separate them from the basal series of weaker and stronger lirae; rostrum with numerous very fine spiral threads. Growth striae strong, sometimes forming fine axial plicules.

White, shoulder cord generally stained with light brown or brownish-orange, sometimes forming large, irregular blotches, subsutural cord often tinged with brown.

Protoconch (Fig. 9) pupoid-conical, 4–5 whorls, glossy yellowish; last three whorls with arcuate axial ribs, numbering about 22 on last whorl; maximum diameter 1,25 mm.

Dimensions: 27,7 × 9,3 mm; 26,3 × 8,2 mm; 18 × 6,2 mm.

Radula (Fig. 17): Rachidian plates transversely rectangular with sharp mesocone and corners of cutting edge raised into weak side cusps.

Range: Japan to Transkei.

Regional locality data: ZULULAND: Ledsman Shoal, 100 m (NM B4000, B4027: A. Connell). NATAL: off Park Rynie, 119 m, sand and sponge-rubble (NM C1606: *MN*), 140 m, do (NM C1575, C1578: *MN*), 136 m, sponge-rubble, solitary corals (NM B3789: *MN*); off Trafalgar, 120 m, sand and sponge (NM B4900: *MN*). TRANSKEI: Off Port Grosvenor, 100–110 m, pebbles, some sand (NM

C616: *MN*); off Mgazi, 92 m, coarse sand and rubble (NM C1845: *MN*); off Rame Head, 100 m, old shell-conglomerate (NM C1825: *MN*); off Ubombo, 96 m, sand and gravel (NM C1849: *MN*); off Whale Rock, 150–200 m, sponge-rubble, and 150–165 m, coarse sand, discoid corals (NM C1829, C1861: *MN*); off Nthlonyane, 130 m, coarse brown sand, old calcareous fragments (NM C1832: *MN*); off Mendu Point, 66 m, coarse sand and rubble (NM C4783: *MN*); off Nqabara Point, 70–75 m, mud, sandstone (NM C4711: *MN*) and 95 m, sponge and sand (NM C4151: *MN*); off Qora River, 100 m, coarse sand, some sponge-rubble (NM C4825: *MN*).

Notes: Southern African shells agree closely with the original figures and description, and with a Japanese specimen from off Tosa in 60–80 metres (NM J3277: M. Azuma). The describers of *G. rarimaculata* did not compare their species with *G. pseudomonilifera* Powell, 1967, of Hawaii, but judging by topotypic examples of the latter (NM G8408) there is a very close resemblance. *G. pseudomonilifera*, however, differs from *rarimaculata* in the total absence of intermediary threads between the three peripheral cords of the base, and in its slightly smaller, brown protoconch (diameter 1,1 mm), instead of pale yellow and 1,25 mm in diameter as in *rarimaculata.*

G. rarimaculata can easily be confused with *G. gilchristi*, which inhabits somewhat similar depths (90–200 m) but appears to prefer substrata of fine sand or mud, whereas *rarimaculata* is usually found on coarse sand and rubble. Although attaining a larger adult size, *G. gilchristi* has a characteristically smaller protoconch (diameter 1 mm or less); it also lacks conspicuous brown markings and has a weaker subsutural cord and wider sulcus.

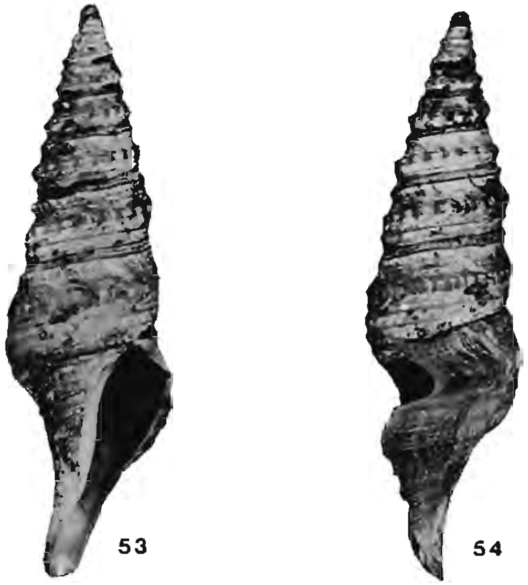
The Pliocene shells from Fiji referred to *Gemmula congener* (E. A. Smith 1894) by Ladd (loc. cit.), are probably *G. rarimaculata.*

Gemmula (Gemmula) championi sp. n. Figs 53–54

? *Gemmula (Gemmula) pulchella* Shuto 'var.'; Kuroda *et al.*, 1971: 221, pl. 57, fig. 10.

Diagnosis: Shell length about 2 cm, narrow, aperture 0,41 total length, rostrum slender, oblique; subsutural cord narrow, weak, bicarinate; peripheral cord on early whorls projecting with about 20 angular, quadrate gemmae, which develop on later whorls into flattened, dense, lunulate plicules; shoulder sulcus very wide and shallow on later whorls; basal periphery of body whorl with 3 main cords, separated by a few finer threads from the basal-rostral series of lirae; light brown overall; protoconch diameter probably about 0,7 mm.

Description: Shell narrow (breadth/length 0,29) with slender, curved siphonal rostrum and high spire, aperture 0,41 of total length; spire slightly cyrtoconic with relatively shallow sutures, teleoconch whorls about 8½. Subsutural cord narrow, much weaker than peripheral cord, bearing 2 thin, rather undulating lirae, the one at the suture being the weaker. Anal sinus widely U-shaped; peripheral cord moderately projecting on early whorls, becoming progressively weaker with growth; gemmae initially rather quadrate and angular in apical view, becoming progressively flatter and more lunulate, until by the penultimate whorl the gemmae form a dense series of arched plicules; sixth whorl with about 20 gemmae,



Figs 53–54. *Gemmula championi* sp. n., holotype, 21,3 × 6,2 mm.

increasing to 31 on penultimate whorl, intervals divided by a slight furrow. Shoulder sulcus much wider than subsutural cord; on early whorls quite deeply concave and subequal to peripheral cord in width, becoming much broader and shallower on later whorls, containing 4 thin spiral threads, crossed by oblique growth plicules. Basal periphery of body whorl with 3 main spiral cords (two showing on spire whorls) with a few fine intermediaries; anterior to these cords is a set of 4 thin lirae (plus intermediaries), followed by a series of initially stronger but progressively weakening lirae. Colour light brown inside and out.

Protoconch eroded, basal diameter probably about 0,7 mm.

Dimensions: 21,3 × 6,2 mm.

Type material: Holotype NM A7154/T2628, Tugela Bank, Zululand, 34–41 metres, fine mud, leg. H. Champion.

Notes: Although based on a single specimen, the taxon is clearly new. It is probably the same species that was figured by Kuroda *et al.* (loc. cit.) as '*Gemmula (Gemmula) pulchella* Shuto var.' from Sagami Bay, Japan. However, *Gemmula granosa pulchella* Shuto (1961: 80, pl. 10, Figs 1, 2, text-Figs 3, 4) was based on a lower Pliocene Japanese fossil which differs widely from *G. championi* in its prominent gemmate ridge, lack of intermediary ridges and its constricted anal sinus. There is closer resemblance to *G. pseudogranosa* (Nomura, 1940), also from Japan, but in that species the shoulder sulcus is apparently deeper and more posteriorly situated; moreover, Kuroda *et al.* (1971: pl. 57, Fig. 7) figure for *pseudogranosa* a shell that has a markedly shorter rostrum than *championi* and is strongly blotched with brown on a white ground.

Another similar species is the tropical Pacific *Gemmula graeffei* (Weinkauff

1875), which, however, has prominent rounded gemmules throughout, more widely-spaced basal ridges with inconspicuous intermediaries and a different shaped aperture. It should be noted that *Pleurotoma graeffei* Weinkauff (1875: 71, pl. 3, Figs 9, 10) is actually the earliest valid name for *Pleurotoma fusca* Hombron & Jacquinot, 1853 (*non* C. B. Adams, 1845), later renamed *Gemmula hombroni* Hedley, 1922. Powell (1964: 263) has introduced confusion by incorrectly applying the name *graeffei* to a different species (perhaps *Pleurotoma concinna* Dunker 1856, *non* Scacchi 1836). Weinkauff's figures of his *graeffei* are small but diagnostic.

Subgenus *Pinguigemmula* MacNeil, 1960

Pinguigemmula MacNeil, 1960: 103. Type species: *P. okinavensis* MacNeil, 1960 (o.d.).

Diagnosis: Shell resembling *Gemmula* s.s., but broadly fusiform, anal sinus a broadly open U-shape.

Notes: Powell (1964) regarded *Pinguigemmula* as a full genus, differing from *Gemmula* in shape of shell and form of anal sinus. These differences appear to be bridged by species such as *Gemmula aethiopica* (Thiele, 1925), and the extremes are certainly no greater than occur in the genus *Clionella*, for example. Moreover, shape of anal sinus varies greatly among individuals of at least one species of *Pinguigemmula* (Fig. 55). The radula, as far as is known *(G. thielei)*, resembles that of *Gemmula s.s.*, save that the rachidian plates are proportionately longer, and have small folds at each corner of the cutting edge; this may only be significant at the species level.

Gemmula (Pinguigemmula) thielei (Finlay, 1930), Fig. 55

Gemmula (Pinguigemmula) thielei; Kilburn, 1971: 130, figs 2e, 4a (references and synonymy).

Notes: Little reliably localised material has been seen. To the localities given previously by me (loc. cit.) the following may be added: off Monte Belo, Limpopo River mouth, 230 fathoms (NM A23: G. Scott). Several specimens in the NM collection are labelled 'off Tongaat' but this South African locality requires confirmation. Study of a fresh radula reveals fold-like denticles in each anterolateral corner of the rachidians; these are present but were not noted in the preparation previously figured (1971: Fig. 2e).

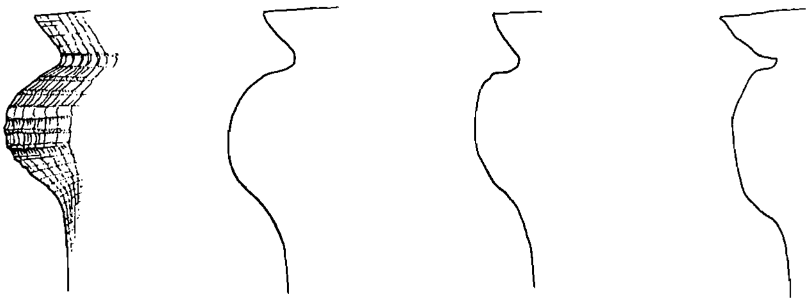


Fig. 55. *Gemmula (Pinguigemmula) thielei* (Finlay, 1930), variation in anal sinus.

Subgenus *Ptychosyrinx* Thiele, 1925

Ptychosyrinx Thiele, 1925: 210. Type species: *Pleurotoma (Subulata) bisinuata* von Martens, 1901 (o.d.)

Diagnosis: Shell resembling *Gemmula s.s.*, but anal sinus typically widely open, siphonal rostrum shorter.

Notes: Practically all modern authors accept *Ptychosyrinx* as a full genus. However, I agree with Shuto (1961) that essential resemblances to *Gemmula* are too great. Although Powell (1964) and Oyama (1966) separated *Ptychosyrinx* by its large rachidian plates (as illustrated by Thiele 1929: Fig. 436), similar plates are now known to occur in many *Gemmula* species. (On the other hand, Barnard (1958) reported rachidians to be absent in *Ptychosyrinx lobata*; however, their absence needs confirmation as he used unstained radula preparations and may conceivably have overlooked these plates.) The openly V-shaped anal sinus, also regarded by Powell and Oyama as diagnostic, is a doubtful character. Thus the type figure of *Ptychosyrinx timorensis teschi* Powell (1964: pl. 223, Fig. 5) shows a sinus typical for *Gemmula*, yet on the other hand *Gemmula microscelida* (Dall, 1895) has a *Ptychosyrinx*-style sinus. Moreover, individual variation within species of *Gemmula* often offers intermediate character-states. The basal lip sinus, sometimes believed to be diagnostic of *Ptychosyrinx*, has been shown to be an occasional malformation that may also occur in *Gemmula*. The concentric operculum reported by Thiele (1925) for the type species, was probably the result of damage and subsequent repair. The protoconch (Thiele 1925: pl. 23, Fig. 4) resembles that of *Gemmula*. I have retained *Ptychosyrinx* as a subgenus but have considerable doubt that its validity can be maintained.

No additional material of the two South African species of *Ptychosyrinx* is available, and these are for the present merely listed.

Gemmula (Ptychosyrinx) lobata (Sowerby, 1903) **comb. n.**

Pleurotoma (Surcula) lobata Sowerby, 1903: 213, pl. 4, fig. 9. Type locality: off Cape Natal, 440 fathoms.
Turris lobata; [partim] Barnard 1958: 107, fig. 3i; (radula; not j), 6; *idem*, 1963: 419, fig. 2b.
Ptychosyrinx lobata; Powell 1964: 290, pl. 224 (holotype).

Gemmula (Ptychosyrinx) lobatopsis (Barnard, 1963) **comb. n.**

Turris lobata [partim]; Barnard, 1958: 107, Fig. 3j.
Clavatula lobatopsis Barnard, 1963: 420, Fig. 2a. Type locality not designated.

Epidirona Iredale, 1931

Epideira Hedley, 1918: M79. Type species (o.d.) *Clavatula striata auctt, non* Gray, 1827 [= *Epidirona hedleyi* Iredale, 1931]
Epidirona Iredale, 1931: 225. Type species (o.d.) *Epidirona hedleyi*.

Diagnosis: Shell with truncated base and U-shaped, peripheral anal sinus, sculpture granular or nodular; protoconch paucispiral, last whorl sometimes carinate. Radula of marginal plates with accessory limb, no rachidians.

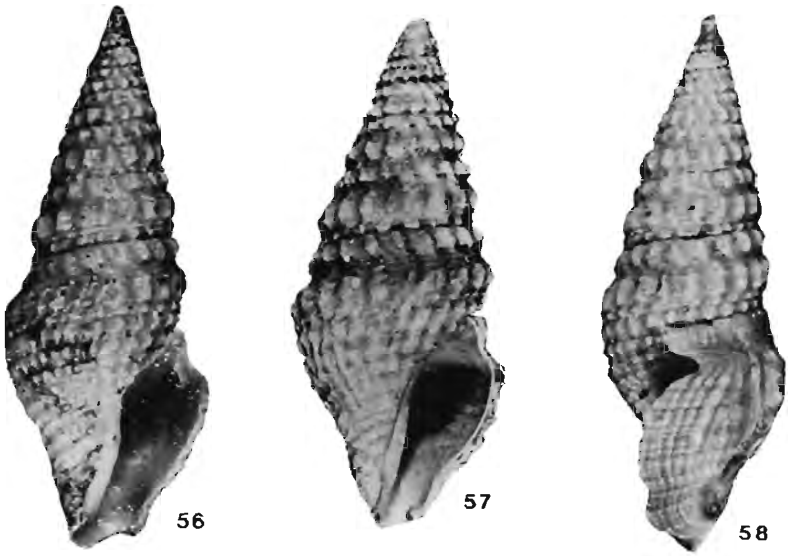
Notes: As indicated above, Iredale's substitute name *Epidirona* was actually unnecessary, and is an objective junior synonym of *Epideira*; although *striata* Gray, 1827, may indeed be a *nomen dubium, striata* Hedley *et auctt.* is undeniably the species later named *hedleyi* by Iredale. Unfortunately nothing is to be gained by restoring *Epideira*, as the name has fallen into total disuse, whereas *Epidirona* has been used by at least eight authors in at least eleven publications over the last fifty years.

Epidirona multiseriata (E. A. Smith, 1877). Figs 56–58

Pleurotoma multiseriata E. A. Smith, 1877: 491. Type locality: Ceylon.
Turris (Gemmula) multiseriata; Melvill, 1917: 145, pl. 8, fig. 3 (holotype); Barnard, 1958: 109, fig. 6c (protoconch); *idem*, 1969: 603, fig. 3c (protoconch).
Epidirona multiseriata; Powell 1964: 299, pl. 230, fig. 3 (holotype).

Range: Malaysia and Persian Gulf to eastern Cape Province.

Regional locality data: ZULULAND: Trawled, no details (NM B1532: B. J. Young). NATAL: Off Mvoti and Umdloti Rivers, 27 fath., off Umhlanga River, 22–26 fath. and off Tongaat, 36 fath. (SAM: s.s. *Pieter Faure*). TRANSKEI: Off N'tafufu River, 50 metres, mud and sand (NM C1031: *MN*); off Nqabara Point, 70–75 m, mud, sandstone (NM C4712: *MN*). EASTERN CAPE: Algoa Bay, 21 fath. (SAM: s.s *Pieter Faure*).



Figs 56–58. *Epidirona multiseriata* (E. A. Smith, 1877): 56, 68, off N'tafufu River, Transkei, 50 m, 13,9 × 5,2 mm; 57, off Zululand, 14,4 × 6 mm.

Notes: Powell (1964) overlooked Barnard's records from South Africa. Local material agrees with figures of the holotype, and with an NM shell from Singapore. The species varies somewhat in relative width (0,38–0,42 of total length in local examples).

ACKNOWLEDGEMENTS

I wish to thank the Council for Scientific and Industrial Research and the National Research Institute for Oceanology for supporting this project. Much of the material studied was dredged from the R V *Meiring Naudé*, the use of which is gratefully acknowledged.

Thanks are extended to Mrs Ruth Fregona for preparation of line illustrations and other assistance, to Dr Masao Azuma for Japanese Turrinae and for generously allowing me to see his drawings of relevant radula preparations, to Dr J. D. Taylor for the loan of the holotype of *Gemmula gilchristi*, and to Mr W. Liltved for the loan of the types of *Turris ambages*.

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Date received: 17 January 1983.